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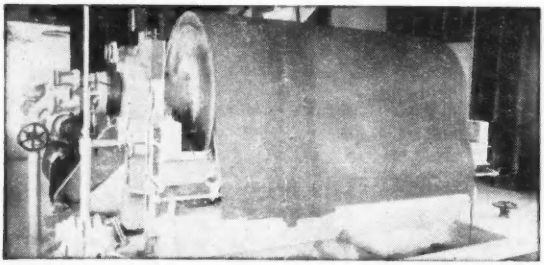

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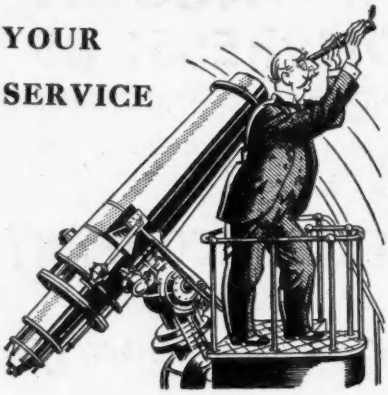

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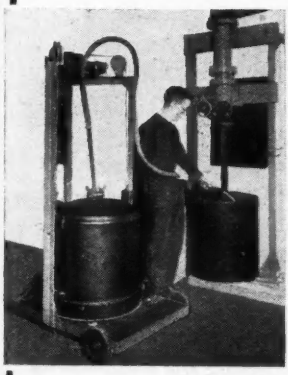

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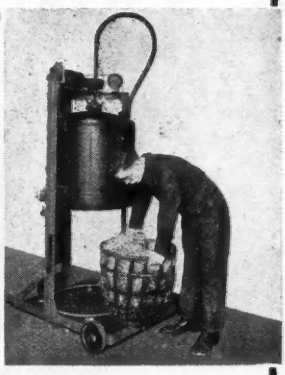

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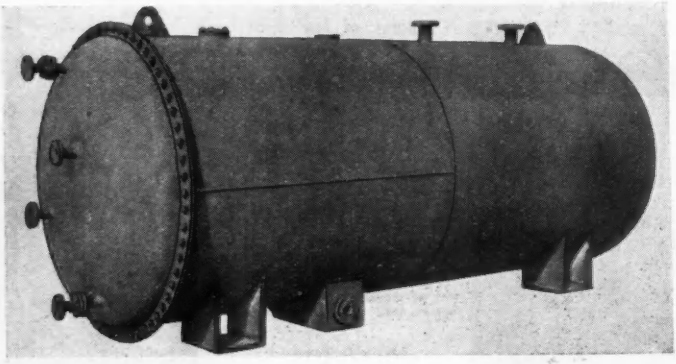

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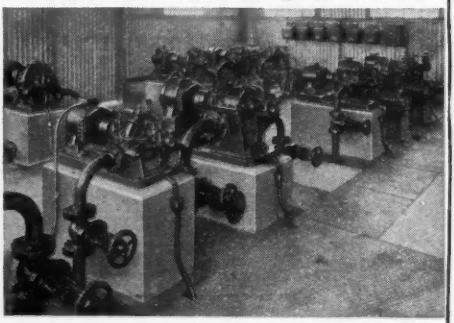

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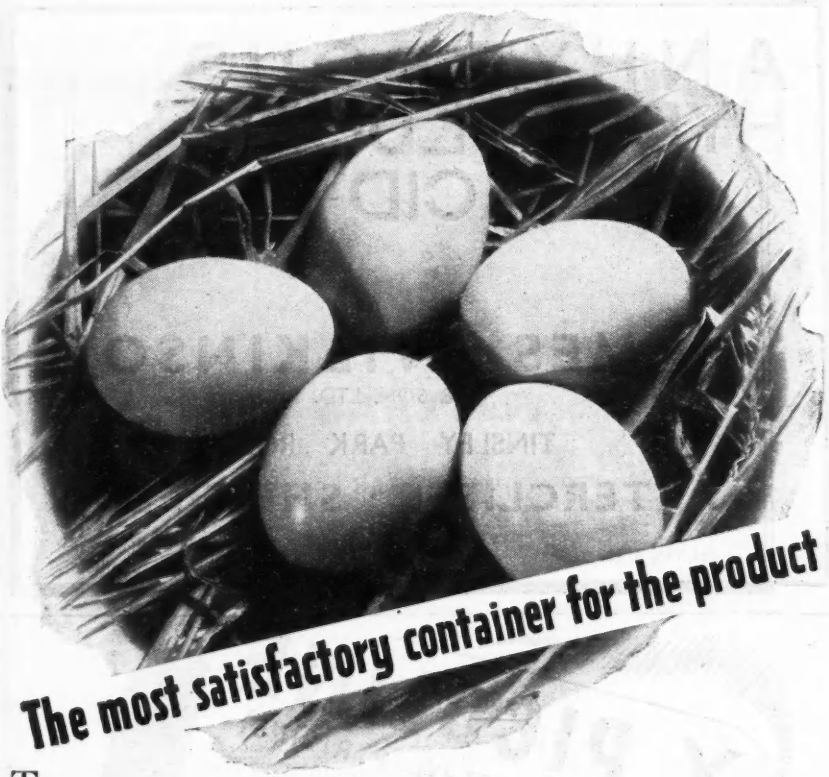

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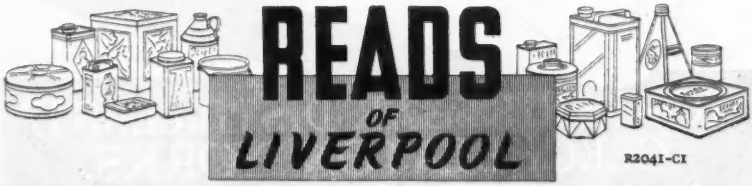

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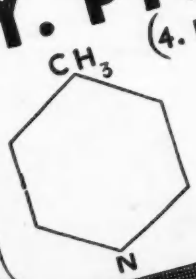

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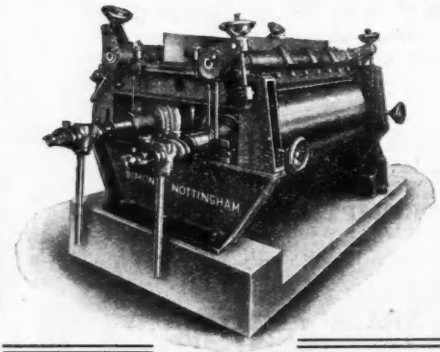

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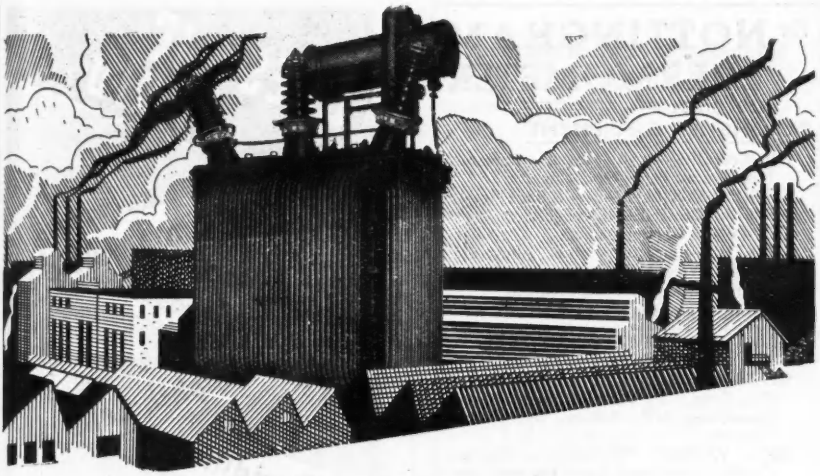

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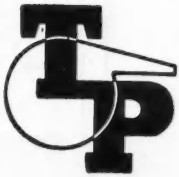

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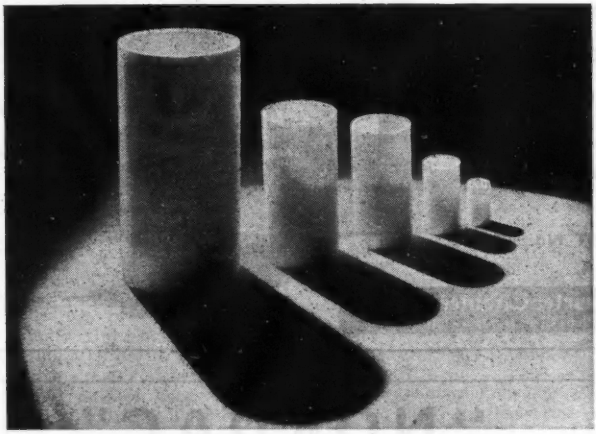

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Wages and Policy

THE labour difficulties through which this country has been passing—slight though they are compared with those of the United States—give rise to some reflections upon which it is necessary to formulate a clear plan of action. It invariably happens that, in the disturbed conditions following a war, conflicting views are held leading to ill-advised action by certain sections of the community. The rising cost of living, the desire for a little more leisure and a greater share of comforts following a period of hardship, inevitably rise to the surface and colour men's actions. It is necessary, however, to preserve a balanced view, and to do that is one of the functions of government.

At present the state of this country is thoroughly unhealthy. There is ample work for everyone—that is a healthy condition, though it may lead to other unhealthy symptoms, paradoxically. With unlimited opportunities to work and earn money, often larger money than usual, there goes a shortage of things one can buy with that money. That can lead to shortage of supply, inflated prices as everyone bids for whatever is available, and ultimately to inflation which will benefit no one. The first condition to bring the nation back to health is to supply sufficient goods to absorb the surplus money. The present government is taking what we may term the typical bureaucratic way out—that of regulation and control. Spending, and therefore inflation, is controlled by taking away the money we earn by taxation. That means that wages are reduced in effect, and discontent is caused. Price control, again, is the method by which the attempt is made to prevent inflated prices being paid for whatever is not bought in the "black market"; again that may superficially be a good policy, but who shall say that price control is not one of the basic causes of scarcity of goods under which we live and suffer?

While the present demands for higher wages, shorter working hours and better conditions of living may not be unusual after a war, the general insistence with which these wills-'o-the-wisp are being pursued is largely the outcome of the political agitation which preceded the election of the present government. Political promises have a way of coming home to roost, and this is the more unfortunate when those who made them never expected to be elected and consequently felt themselves safe in raising hopes that could never be justified in order to embarrass their political opponents. We have

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now the position almost that every trade union is asking for increased wages, decreased working hours, and so forth—*and their demands are being granted*. It is easy to grant them when everyone is prosperous; but for how much longer will everyone remain prosperous if the cat goes on chasing its tail in this way? The wage earners in one industry after another are being granted increases. As each industry gets an increase, its costs must rise and its prices to the consumer rise. That means that the cost of living rises, and with that comes a demand for higher wages. Thus the inflationary spiral goes merrily upward, no one being one penny the better as the result, until in the end British prices will be so high that no foreigner can buy from us. Then comes the crash. To avoid this a halt must be called to the rising cost of living and the rising wages.

Clearly there must be a national wages policy, agreed by the trade unions, the Government as neutral intermediary, and the employers. The trade unions have sufficient trained economists on their headquarters' staffs to recognise that so long as the cat chases its tail, we shall get nowhere and only sink deeper into the mire. The standard of living in this country must depend not on how much money a man earns but upon how much goods are available. When we produce more, when we can earn enough to import more, the standard of living of everyone can rise accordingly. It should not be difficult to convince the trade union leaders on that point. The real difficulty will be that of bringing the truth of the matter home to the rank and file. They cannot be expected to master economic facts, particularly when they have been educated by agitators, including, we fear, some who should have known better, to suppose that they need only to get control of industry for the golden age of universal plenty to dawn. The difficulty of getting the true facts over to the workers is all the greater because the trade union leaders appears to be out of touch with their members. The recent transport strike demonstrated that in a remarkable way. There would seem to be need for a drastic overhaul of trade union procedure. It is all very nice for the Socialist members of Parliament to demand a public inquiry into the Press; we suggest that the Press should demand a similar inquiry into the trade unions.

It is very necessary, not for any political reason but for the economic survival of the nation, that wages and conditions of work in the various industries should be correlated through a national policy. So long as one section asks for something and gets it, while another has not got it, there will be trouble. Conditions should not depend upon the negotiating strength of a union nor on the chance attitudes of independent members of statutory boards, but upon a national policy.

Work or ——

THE Government's White Paper on the economic position of this country ("Economic Considerations affecting Relations between Employers and Workers") was issued at the beginning of this week. It is a grave document. It pronounces as "extremely serious" the economic position of this country. It exhorts to greater production on pain of a lower standard of living. And although it does not say so in so many words it hints to the workers that they cannot get higher wages without increasing the cost of production and bringing about serious repercussions on the country's economy. The warning about the danger to our standard of living, which runs like a thread throughout the whole document, is necessary so as to bring it before certain classes of the community who do not understand the gravity of the situation, although to many people the red light has been visible for many months.

But if this warning is to be taken into the workshop, the language and style of the White Paper will have to be materially altered to get the message across. The White Paper is not so abstruse and lengthy as some we have read; nevertheless it is still above the heads of the majority of workers. We do not agree with the managing director of a popular daily who ordered his reporters to write down to a mental age of seven which represented, he thought, the average intelligence of his readers. The level will be found about half-way between the newspaper proprietor's estimate and the White Paper. And

the message must be contained in pungent, staccato sentences which will leave no doubt in the minds of the readers what they mean. The rolling phrases used in parts of the report will not grip the attention of the working man. To say " Until the output of British industry is considerably increased there is bound to be some fear of our ability to maintain the stability of prices and the orderliness within our industrial system which have characterised Great Britain throughout all the difficulties of the war and the transition from war to peace " has not the same appeal to the worker as " You must work harder to fill your belly."

There are assumptions made in the White Paper with which we do not entirely agree. It assumes that everything will right itself when there is sufficient man-power. It suggests that with the addition of 560,000 more workers the export target could be reached. Figures given within the document itself show that there are 366,000 unemployed and 345,000 ex-Service men and women who have no jobs, a grand total of 711,000 people looking for work. And that is apart from those who could be spared from the large numbers of men and women in the forces, numbering 1,510,000 compared with 480,000 in mid-1939.

But will mere weight of numbers improve our economy? We do not think so. At the present moment thousands of workers in the steel, chemical and glass industries are on short time or being put off owing to shortage of raw materials or lack of fuel. These industries certainly do not need more workers—at least not until there is increased production elsewhere. Greater emphasis should have been placed on increased production rather than on increased man-power. It is true new equipment and more workers are needed in many industries, but the most important thing that is required at this moment is a new spirit in industry among the workers which will provide the incentive to greater production. We hope the warning contained in the White Paper will produce the incentive.

NOTES AND COMMENTS

DIMINISHING DEATH ROLL

ONE welcome evidence of the relaxation of some war security measures is the reappearance in the form of a White Paper of the annual reports of H.M. Inspectors of Explosives, seven of which have now been issued simultaneously covering the whole period of hostilities. Although the story is necessarily one of needless death and destruction, frequently precipitated by some inexplicable lapse on the part of one worker, the record is by no means wholly black, relieved as it is by the great reduction in the number of accidents in explosives factories since 1943. In 1942 there were 629 such accidents in which 15 lives were lost in 1943 there were 634 and ten lives lost; although in 1944, 17 were killed, accidents had nearly been halved—352; and in 1945 the total had been cut to 156 and only four lost their lives. While the last figures offer no grounds for complacency—representing 53 more accidents than in the last year of peace—there is encouraging evidence that the lessons of previous disasters have not been in vain, and these lessons are now being most effectively emphasised in the analyses by the Inspectors of the circumstances in which they occurred and the best means of preventing their repetition. One most disturbing feature, briefly referred to in the reports, for which no blame attaches to our manufacturing methods, has been the appalling toll of needless death and injury inflicted by war, and occasionally industrial, explosives falling into the hands of unauthorised persons, principally children. Now, at last, this needless casualty list is diminishing, due largely to the fact that military units no longer scatter lethal appliances at large. But there remains to users and manufacturers of industrial explosives a responsibility as urgent as ever to ensure that their stocks cannot fall into the wrong hands. Instances of high explosives kept where children can gain access are still common, although manufacturers themselves are seldom guilty. One most obvious means of curtailing this tragic record would be to standardise at a high level the penalties on those who improperly acquire explosives or fail to safeguard them. The disparity between such penalties exacted by the Courts is unaccountable, ranging from £5 to £125 for substantially the same offence

by industrial users; while juveniles who have so frequently ransacked explosives stores are commonly put on probation.

INSTITUTE OF MANAGEMENT

AS reported in a recent issue, the British Institute of Management has been launched. So far only the Council has been formed. This, necessarily, was the first step, pending decisions on the organisation and membership of the Institute, and the qualifications, if any, to be demanded of would-be members. The council is a strong one, including many well-known industrialists, as well as representatives of the Federation of British Industries, the Trades Union Congress and the Civil Service. The formation of the Institute which was recommended by the Baillieu committee last April, is an important step which may help the country to resolve the grave economic difficulties which are facing her at this moment. Good management, as we pointed out in our issue of December 7, demands qualifications which cannot be acquired in college, nor yet be hereditarily passed on from father to son. Success in management implies an understanding of the difficulties of and friendly relations with labour, a constant watch on consumer requirements and good internal organisation. In the newly-formed Institute those who have not the happy knack of confident direction of business may receive guidance and direction. Faulty methods of management which can lead to high costs or labour troubles and ca-canny working by employees and may, in part, account for the falling man-power output, may be corrected by suasion and example of the Institute.

STATUS OF A MANAGING DIRECTOR

THE position of a managing director in relation to the law of master and servant was discussed by the Chancery Court in a recent case. It arose in this way. The managing director of a firm had a seven year contract which ran out in 1943. He stayed at his work, as his company's various factories were covered by the Essential Work Order. In 1945 he was dismissed. He claimed that he could not be dismissed as the Essential Work Order was still in force. Lord Justice Cohen first considered whether the managing director was a "worker." Despite previous cases in which it had been decided that a director or a managing director is not a servant of his company, the judge held that on the facts of this case the managing director was a "worker." His contract bound him to full-time employment with his company. The Essential Work Order used the word "worker" in its widest sense and this could include a full-time managing director. But, the judge held that the managing director was not covered by the Order because he was not employed "at" or "from" any particular address, as required by the Order. He was generally responsible for all the company's undertakings. It may well be that the decision would have been different if the managing director had been responsible for an undertaking at one address only.

Looking Back

From our file of 28 January 1922

"Both old and young are by now fully aware that the much advertised fruits of victory are nothing but the need for hard work. . . .

"The great bulk of the population still entertains the fallacious theory that the big income comes from out of the pockets of the poor. It will not be long before the poor realise the futility of the committees, councils and unions upon which they now rely with such implicit faith." (*Leading article*).

"The export demand still leaves a great deal to be desired, although it has been better than has been the case of late." (*Market Report*).

"Papers by Professor W. A. Bone and Sir E. Rutherford are to be read before the Royal Society." (*News*).

"All fabrics displayed at an exhibition at the Victoria and Albert Museum are guaranteed to be British dyed."

The continued upward trend of wholesale commodity prices in Holland is evidenced by the report of H.M. Commercial Counsellor at The Hague, recording slight increases in August-September in the indices of the three main groups—food, raw materials and finished products—raising the total index figure from 257.1 to 259.2. Chemicals advanced 2.8 per cent to 279.9 and chemical products 1.0 to 300.9.

PRODUCTION OF ALUMINA BY THE LIME SODA PROCESS—I

by W. E. PRYTHERCH, M.Sc., F.R.Ae.S., M. L. R. HARKNESS, B.Sc., and W. D. SPENCER, Ph.D., F.R.I.C.

THE tragic story of Britain's lost predominance in the production of non-ferrous metals, of her pioneering and leadership in the technique and practice of mining and smelting copper, tin, lead and zinc, and of the decline of this leadership due to overseas competition, financed largely by British capital, is too well known to need recounting here. It is mentioned only, in fact, to draw attention to the possibility of a similar story being repeated, in the not too distant future, in the British aluminium industry.

Although this country may not claim ever to have been the leader of the world aluminium industry, as it has been in the production of other metals, it was among the very first commercial producers of the metal —the first aluminium works in this country having started at Battersea in 1858 only 31 years after Wohler had first isolated the metal and only four years after the first commercial process had been developed by Deville in France. The Deville and similar chemical processes, however, did not produce aluminium at a price which would enable it to be used as a structural material; by 1885 world production had reached a total of only about 50 tons, and the price was 28s. per lb.

Increased Production

The discovery in 1886 of the electrolytic reduction process by Hall and Héroult, the use of which has continued right up to the present day, brought a rapid reduction in price and a consequent increase in demand. The British Aluminium Company came into being in 1895, being preceded in the field only by the U.S.A., France, and Switzerland. The aluminium works were at Foyers in Inverness-shire and were supplied with alumina, made by the Bayer process, from works at Larne in Ireland. At first, production was entirely domestic, as the alumina was obtained from the Irish bauxite of County Antrim, but in 1899 this was abandoned in favour of the higher quality bauxite from the South of France.

The price continued to fall and production to increase until in 1900 the price was about £110 per ton (equivalent to the present war-time price), and world production was at the rate of 5000 tons per annum. By 1910 the price had fallen to about £60 per ton—the lowest price on record, and production had reached 50,000 tons annually, of which this country as the fourth largest producer accounted for about one-tenth.

On the story of the now much discussed cartellisation and the increasing prices of the following years, we need not dwell. Suffice it to say that by 1938, with the world price of aluminium fixed at £94 per ton, this country, with a total annual production of 23,000 tons out of world total of 579,000 tons, was placed ninth among the world producers of aluminium after Germany, U.S.A., Canada, U.S.S.R., France, Switzerland, Norway, and even Italy, with the doubtful extenuation that a part of the Norwegian production was British owned.

Big American Output

The black-out of production statistics in most countries since the outbreak of war prevents the giving of a factual picture of the present-day aluminium industry, but such figures as have been published recently indicate that so far as we are concerned the situation must have worsened considerably. We know, for instance, that the total aluminium producing capacity of the U.S.A. and Canada has reached 1,500,000 tons—nearly three times the total world production of 1938, and we must assume that in Axis-controlled Europe, to say nothing of Russian and Japanese production, considerable increases in capacity must also have been made. The annual capacity which will be available after the war cannot be less than two million tons and will probably be very much higher.

Of British production, no figures may be published, but it is not generally considered that they have increased to any considerable extent during the war. We have, however, greatly increased our aluminium fabricating plant, and a huge new industry, second only to that of the U.S.A., is now faced with the alarming prospect of being largely dependent upon imports for its principal raw material.

It might be argued that there will be such a huge potential for over-production of aluminium in other countries after the war that overseas producers will be only too pleased to sell us all the aluminium we can use at very favourable prices—at prices made possible by the writing-off of the huge capital investment in their plants and hydro-electric works before and during the war. This may be an attractive financial argument, but is entirely contrary to the

economic thesis on which this memorandum is based.

However, the situation would be made a little more attractive if domestic production had been increased on pre-war lines, depending as it would on imports of raw materials suitable for the Bayer process—*i.e.*, bauxite from France or British Guiana. Whatever the pre-war advantages of such an undertaking the war-time disadvantages of shipping four or five tons of bauxite across the Atlantic for every ton of aluminium required would manifestly have added to any shipping difficulties.

What the situation really calls for and called for long before the war came to throw it into relief—was a process to free aluminium from reliance upon bauxite. That this necessity is not peculiar to this country is evidenced by the continual research which has been carried on in nearly every aluminium-producing country to develop alternative processes—in fact, one might go so far as to suggest that much of this research has been carried on in countries in which freedom from reliance on bauxite was not so vital as it undoubtedly is here.

The known deposits of bauxite of a quality suitable for aluminium production occur, as will be seen from Table 1, in a relatively few widely separated areas throughout the world. The known deposits of bauxite, except those in the U.S.S.R., of which very little is known outside that country, are discussed in detail later on. The total known reserves amount to just under 900,000,000 tons. No doubt other deposits exist in relatively inaccessible areas of the world, but the figures for European deposits which amount to 366,000 tons, excluding Soviét reserves in this table, may be taken as a reasonably accurate estimate of deposits available without extensive deep mining.

In spite of this, alternative sources of aluminium and alumina will eventually become essential. There has been a great deal of talk in in recent years about plans to conserve raw materials for future generations, but in the case of aluminium this is not the vital problem that it is in the case of coal and oil, since, although bauxite reserves may be inadequate, there is such an abundance of aluminium in other forms that one cannot visualise that there should be a shortage of this material for thousands of years.

In the opinion of the authors, for purely economic reasons there must be developed in the immediate future the use of other and more readily available sources of aluminium and if this is the case, then the bauxite resources, especially those more remote from industrial areas, may well remain unused except perhaps for the production of refractories.

Attention has already been drawn to the wide dispersion of the known deposits of bauxite and a further glance at the map will show the great distances between most of these deposits and coal.

In the production of alumina by the Bayer process or by most of the alternative processes which will be discussed later, a considerable quantity of coal is consumed—in fact, in the Bayer process the ratio of coal consumption to bauxite consumption is roughly as $2\frac{1}{2}$ is to 2, and since these two

TABLE 1

WORLD RESERVES OF BAUXITE

Country	Bauxite Bearing Areas	Reserves in Millions of Tons		Financial Control	Production in Metric Tons
France	Var, Hérault, Ariège and others	60		French, British, Swiss and American	693.400
U.S.A.	Arkansas	25			
	Georgia, Alabama, Tennessee	10	37	American	324.000
	Mississippi	2			
Dutch Guiana ...	Surinam River and others	100		American and Dutch ...	378.000
British Guiana ...	Demerara and others ...	60		American and British ...	470.000
Hungary	Bakony	140	150	Hungarian, British ...	540.000
	Cant	10			
Italy	Istria	10	16	Italian, German and Hungarian	383.100
	Aquila, Benevento ...	6			
Yugoslavia ...	Ornis, Bar, Koter, Mostar and others	80		Yugoslav State, German, British, American, Hungarian and French	404.500
British India ...	Jabalpur and others ...	30		British, Indian	30.300
Rumania	Bihar	20		German, Hungarian ...	10.700
Greece	Distomon	10		Rumanian, Swiss, German, Greek	140.000
Dutch East Indies	Bistoog, Bintam ...	20		Dutch	243.000
Gold Coast (British)	Sefwai	50			
	Janahin	180	234	Not exploited	
	Birrim	4			
Nyasaland	Lichenya	20		Not exploited	10.000
French Morocco ...	Atlas	20		Not exploited	
Australia	New South Wales	4		Not exploited	5.000
Norway	Jan-Mayen	30		Not exploited	—
		891			

TABLE 2

U.K. BAUXITE IMPORTS

From	1934	1935	1936	1937	1938	1939
France	149,450	172,731	187,451	182,178	207,944	—
Greece	—	7,900	25,453	17,556	20,864	—
British Guiana	1,630	6,027	7,855	17,821	19,845	—
Italy	7,367	7,164	—	—	—	—
Other British Countries ...	1,223	609	1,279	872	590	—
Other Foreign Countries ...	1,503	11	9,406	1,005	355	—
TOTAL	161,173	194,442	231,444	219,432	249,598	302,112

U.K. CRYOLITE IMPORTS

Denmark	1,449	1,983	2,088	2,190	5,290	—
Greenland	—	—	567	256	—	—
Others	6	21	—	1	—	—
TOTAL	1,455	2,004	2,655	2,447	5,290	4,663

raw materials are so widely separated, a considerable amount of transport is required to bring them together. Obviously, since the quantity of coal consumed is the larger, and since the coalfields usually abound with industrial amenities, the bauxite is brought to the coal. In the case of this country this means that taking bauxite by sea from the South of France to the Bayer plants here involves transport of the order of 8000 ton-miles for every ton of aluminium produced—obviously an item which must have an important effect on the cost of the aluminium produced.

Apart from capital charges the three main items of cost in the production of alumina by the Bayer process are bauxite, coal, and caustic soda. Bauxite and coal are both used in large quantities, about 4 tons of the former and 5 to 6 tons of the latter being required to produce enough alumina sufficient for the production of 1 ton of aluminium. The large volume of raw materials used, therefore, makes the siting of the alumina plant in relation to deposits of bauxite and coal a question of economic importance. Ideally, of course, the site should be one with deposits of suitable coal and bauxite close at hand in order to minimise transport costs, which become an important item when dealing with such large volumes of materials.

Unfortunately, nature has not provided for this happy state of affairs, and there are few, if any, locations where bauxite and coal are reasonably close together, and the practice in the past has been to ship the bauxite to the coal since the amount required of the former is the lesser and, moreover, there are generally better industrial amenities in the coal-producing localities.

In this country's case, unless we are going to be content to import the bulk of our aluminium metal, the importance of locating the plant on a coal field is even more urgent, since, in the absence of water power to provide the quantities of aluminium in demand, the power for the reduction of the alumina to aluminium metal must come from coal, and another 7½ tons of it for each ton of aluminium produced by the orthodox electrolytic process is needed. Thus, the two stages in the process of producing aluminium will call for about 12½ tons of coal, so that our site must obviously be where the cost of this, our most expensive single material, is cheapest, that is, as close to the pit-head as possible.

The other raw material required in large quantities are aluminium containing ores. Considering bauxite first, there are no large deposits of bauxite of high enough quality for successful commercial operation of the Bayer process available in the British Isles —our nearest source of supply is the South of France. Particulars of imports of bauxite into the United Kingdom are given in Table 2.

TABLE 3

U.K. IMPORTS OF ALUMINIUM (NOT INCLUDING SEMI-MANUFACTURES)

From	1934	1935	1936	1937	1938	1939
Canada	11,550	15,180	16,658	20,239	30,415	—
Switzerland	2,030	2,440	4,245	6,261	9,550	—
Norway	180	290	665	4,312	5,350	—
France	32	1	—	5	530	—
India	120	13	140	229	292	—
Germany	247	6	—	290	—	—
Other Countries	62	55	14	221	130	—
TOTAL	14,222	17,983	21,719	31,572	46,257	57,812

If we rely on bauxite we must be prepared at the very best to pay, in addition to mining costs, the cost of shipping four tons of this material several hundred miles for every ton of aluminium we produce, and thus we cannot look for any saving in cost from this source.

For purely strategic reasons, we would do better to rely on imports of metal rather than four times the volume of ore from overseas, although there are obvious economic reasons why, even if we must continue to depend on imported bauxite, as much of its processing as possible should be

done here. The imports of aluminium into the United Kingdom for the years 1934-1939 are shown in Table 3.

It is still far too early to attempt to give any conclusive figures for the bauxite resources of the world, since nearly every month brings tidings of newly-discovered deposits, which although they are, in many cases, too small to be of serious import, occasionally contain workable reserves. Even the figures given for the extent of well known deposits must be regarded as tentative. As a matter of fact, in spite of gloomy predictions current to-day of the imminent exhaustion of all kinds of minerals, so far no instance is recorded of any mineral being worked out completely. On the contrary, such deposits as have ceased to be exploited have been abandoned in favour of richer, more easily worked deposits in other parts of the world.

Bauxite Reserves

The wariness of economic-geologists is instanced by a report on the Bauxite Resources of the United States published by the U.S. Bureau of Mines in November, 1941. According to this report, the estimated reserves of metallurgical grade in the United States were 9,343,000 tons of bauxite containing over 55 per cent of Al_2O_3, and less than 7 per cent SiO_2, and 8,898,000 tons containing 50 to 55 per cent Al_2O_3 and less than 15 per cent SiO_2, which the recent development of the lime-soda process has rendered useable for aluminium production.

Thus, the total reserves of metallurgical grade bauxite were estimated at about 18,000,000 tons in 1941, and yet by August, 1943, this grade of bauxite was being mined at the rate of 8,500,000 tons per annum and further exploration has shown that between five and six years' supply at the expected rate of 1944 consumption (5,500,000 tons) can be expected in the U.S.A.[1]—*i.e.*, 27,500,000 to 33,000,000 tons, which together with the quantity mined between 1941 and 1944 must be more than double the reserves estimated in 1941.

Other difficulties which confront the would-be compiler of figures for bauxite reserves, is the wide range of chemical composition covered by this definition (for instance, the aluminium content of bauxite may vary from 30 up to 60 per cent and more) and the fact that the whole range of this variation is often found in published analyses of samples taken from a single deposit, so that the composition of the bulk of such a deposit cannot safely be predicted until thorough sampling has been carried out. Accurate placing of freshly discovered deposits is further complicated by the obscurity of many of the place names given for the sites of such deposits and, in the peculiar case of Europe, the flexibility of international frontiers which may lead to a country being credited with enormous deposits one year and none in the year following.

The following notes on the bauxite deposits of the world, must, in view of these difficulties of accurate or conclusive assessment, be regarded as extremely tentative, but for the purpose of the argument herein presented may, nevertheless, be assumed to give a broad outline of the world's bauxite reserves with sufficient accuracy for our purpose, since although it is probable that geologists will continue to discover new deposits, it is reasonably certain that they will be further and further removed from existing centres of industry and from large markets, if not from coal—*the principal auxiliary raw material* of the aluminium industry. Allowing, therefore, a considerable margin for error, let us consider a typical estimate of the known bauxite reserves of the world—Table 1. It will be seen that the estimated total is about 900,000,000 tons. Before the war, only about half of the bauxite mined was used for immediate aluminium production,* the remainder going on to stock piles and for a number of other purposes such as refractories, abrasives, and industrial chemical compounds of aluminium.

It must be very doubtful indeed if these other markets for alumina have maintained anything like the rapid increase which has characterised the aluminium producing industry during the past few years, but for the purpose of argument and also to allow for the fact that only a proportion of the available bauxite is suitable for aluminium production, we will assume that only half of this reserve is available to the industry—*i.e.*, 450,000,000 tons.

Estimated Aluminium Production

We do not know what the annual world production of aluminium is to-day, although we can make the rough assessment that it is somewhere between 2 and 3 million tons, certainly not less, since the United States and Canada together have capacity for more than 1,500,000 tons. If, therefore, the present capacity for aluminium production were to continue to be utilised to the full, the rate of consumption of bauxite (assuming 4 tons of bauxite to 1 ton of aluminium) would be between 8,000,000 and 12,000,000 tons per annum, in which case half the apparent reserves would last at least another 40 to 50 years.

It seems fairly certain, therefore, that in the immediate post-war years, the supplies of bauxite will be quite adequate for any demand which can now be foreseen. However, we should be extremely ill advised to forecast developments beyond that short

* Total aluminium production for three years, 1935–37, was 1,100,000 tons, representing roughly 4,400,000 tons of bauxite. Total bauxite production for the same years was 8,250,000 tons.

period of time, and it may well be that long before 40 years have elapsed scientific, technical and social progress may have completely changed the aluminium situation, and all the bauxite may have been exhausted or, on the other hand, it might no longer have any commercial importance.

Because our interest in bauxite in this instance is confined solely to its use as a source of aluminium, we must of necessity take into consideration the locations of bauxite deposits relative to those of the other principal requirements of the aluminium industry—namely, coal and electric power, which latter may again depend on the close proximity of coal or it may be generated from very large resources of flowing water.

We have, therefore, in the following notes, attempted to include some details of the available sources of coal and hydro-electric power and here again, we must ask the indulgence of our officially informed readers for the omission of some of the more recent developments in hydroelectric power generation. Again, we would draw attention to the importance of the location of generating sites in relation to markets

Europe

France :

This is among the most favoured nations as regards resources for aluminium production. Deposits of bauxite of suitable quality occur at various localities in the southern departments of Ariège, Hérault, Bouches-du-Rhône, Var, and others, and from these deposits most of the world's requirements for bauxite were at one time produced.

Situated near the minor coalfields of southern France and the highly developed water power resources of the Rhône Valley (5,500,000 h.p.), these deposits are well placed and should continue to repay exploitation for many years to come. They are also very well placed for export to other countries, notably Great Britain, since they occur in close proximity to such ports as Toulon and Marseilles, whence they can be shipped direct to our alumina plants without the added expense of rail transport. The total reserves of these deposits are estimated at about 60 million tons, which would give them, at the pre-war rate of output, a life of about 90 years, or very much longer if used only for domestic aluminium production at pre-war rates.

Hungary :

The extensive deposits in Hungary are much more recent in terms of commercial exploitation. The principal deposits occur in the north of Lake Balaton, and at Csakyer (Bakony) on the south of the Vertes Mountains. A further deposit has recently been discovered in the mountain region of Borzoeny, near Budapest.[2]

Estimates of the potential reserves of bauxite in these deposits vary widely, figures as far apart as 30[3] and 150[4] million tons being quoted. In any case, the output in 1938 was the second largest in the world after that of France, and it is understood that during the war further extensive development has been undertaken. It will be seen from the map that these deposits are well situated to supply an aluminium industry based on the coal and hydroelectric power of Czechoslovakia and Austria.

Yugoslavia :

Large deposits of bauxite occur near the Adriatic coast of Bruvno, Drnis, Mostar, and Bar. The country is mountainous and there are no coalfields in the locality, and it would appear that the utilisation of these deposits will depend, as in the past, on their export to countries more favourably placed with regard to coal and electric power. Their position relative to the coast, particularly the Bar deposits, marks them for favourable consideration from this point of view. It had been reported, however,[5] that aluminium reduction works were to be erected by German companies in Croatia. One of these was to produce 50,000 tons per annum. A plant at Mostar was to treat 100,000 tons of bauxite per year. Dams were to be built to harness the Nevetra River. It was stated that when these plants were in operation, no more bauxite would be exported from Croatia. The reserves are estimated at 80 million tons, of which 30 million tons are at Bar.

Greece :

A reserve of 10 million tons of bauxite is credited to Distomon, north of the Gulf of Corinth. Owing to the absence of coal, to the relative smallness of the reserves, and to their favourable position for sea transport, these deposits will probably continue to be worked for export.

Russia :

There is little reliable information available regarding bauxite deposits in European Russia, although it appears that she is at least self-sufficient in this respect. Her domestic output in 1938 was estimated at 250,000 tons, practically all of which would be consumed in her reported aluminium production of 50,000 tons. Statements of Russia's bauxite reserves tend generally to claim them to be large, as indeed one would expect in so large a territory. However, the interest shown in the Russian scientific and technical journals in research on alternative raw materials such as coal-ash and clay, suggest that they may

not be quite as extensive, or as favourably located, as the planners could wish.

According to a recent review,[6] bauxite deposits occur in the northern and central Urals. The principal deposit is at Krasnaya, Shapockha, north of Serov (formerly Nadejdinsk) on the left bank of the Vagram river. The deposit is said to contain 9 million tons with 5 million tons of first and second quality (Al_2O_3 — 56 per cent, SiO_2 — 3.5 per cent, and Fe_2O_3 — 27 per cent). Output was 150,000 tons in 1937. Another deposit is at Sokolovskoe—10 miles east of Kamensk. It contains 2¼ million tons.

Deposits of inferior quality, and therefore undeveloped so far, occur at Alapaievsk, at Resh in the northern Urals. Important deposits have been discovered in the southern Urals, Bashkirian Republic, in the Malofasensk area. These are estimated at 6 million tons with a potential of 10-12 million tons.

Italy:

The principal deposits, estimated at 10 million tons, are in the Istrian Peninsular and a further 6 million tons are credited jointly to deposits at Aquila and Benevento. The Istrian deposits are well placed in relation to hydroelectric power in North East Italy, where aluminium has been produced for some time (estimated output in 1939—30,000 tons), but coal has to be imported either by sea from Great Britain or over land from Germany (or Czechoslovakia).

Rumania:

In the Bihar Mountains there are said to be deposits of bauxite amounting to 20 million tons. Like other resources of this country, including hydroelectric power and coal, these deposits were not extensively exploited before the war, but being within reasonable distance of coalfields, the deposits might well be exploited for domestic production.

TABLE 4

TYPICAL ANALYSES

	Germany (Giessen)	Greece	Italy (Compagne)	Croatia	Dalmatia	Rumania	Spain
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
SiO_2	4.6	3.84	2.52	0.37	0.87	1.49	10.87
TiO_2	—	0.18	1.27	8.51	—	3.12	—
Al_2O_3	49.97	54.35	58.40	55.43	59.27	59.66	51.64
Fe_2O_3	19.87	18.95	24.12	21.78	24.36	23.66	—
H_2O	24.54	12.24	13.11	13.46	5.93	11.81	36.60

North America

United States :

The principal deposits of metallurgical grade bauxite occur in Pulaski and Saline Counties in the State of Arkansas from which the material is now being mined extensively. These deposits have been nursed for many years against an emergency such as that during the war; the principal sources of bauxite for the large pre-war U.S. aluminium industry being Dutch Guiana. Other significant deposits of metallurgical grade bauxite occur in the states of Alabama, Georgia, Tennessee, and Mississippi, and most of these have been worked during the war.

The latest estimates put the bauxite resources of the U.S.A. at about 30 million tons, although all of these might not prove economical to mine under peace-time conditions. Location relative to coal and hydroelectric power is generally favourable.

Canada :

So far, no important deposits of bauxite have been revealed in Canada whose great aluminium industry, second only to that of the United States, has drawn most of its bauxite from British Guiana. Canada, in fact, like Norway and Switzerland, provides an example of an aluminium-producing industry based primarily on cheap hydroelectric power.

TABLE 5

TYPICAL ANALYSES

	Alabama	Arkansas	Georgia	Tennessee
	per cent	per cent	per cent	per cent
SiO_2	2.90	2.00	2.31	12.13
TiO_2	3.40	3.50	2.00	—
Al_2O_3	58.21	62.05	60.64	57.56
Fe_2O_3	3.60	1.66	1.33	1.34
H_2O		30.31	33.37	28.97

South America

British Guiana :

Very extensive deposits of high quality bauxite occur along the coast of British Guiana and these are worked principally along the Demerara and Essequibo rivers to enable the bauxite to be loaded direct into sea-going vessels for transport to Canada and Great Britain. Reserves are estimated at 60 million tons and in 1938 these were being worked at the rate of 470,000 tons per annum. There is no important coal near these deposits, and it would appear unlikely that in the immediate future an aluminium industry will be built up in British Guiana.

Dutch Guiana :

The bauxite deposits of British Guiana are continued into Dutch Guiana, which is credited with 100 million tons. The United States takes most of the output from these deposits.

TABLE 6

TYPICAL ANALYSES

	British Guiana	Dutch Guiana	French Guiana
	per cent	per cent	per cent
SiO_2	2.20	1.50	—
TiO_2	0.60	0.90	—
Al_2O_3	64.70	64.61	64.00
Fe_2O_3	0.90	1.20	1.50
H_2O	31.60	31.80	33.51

Africa

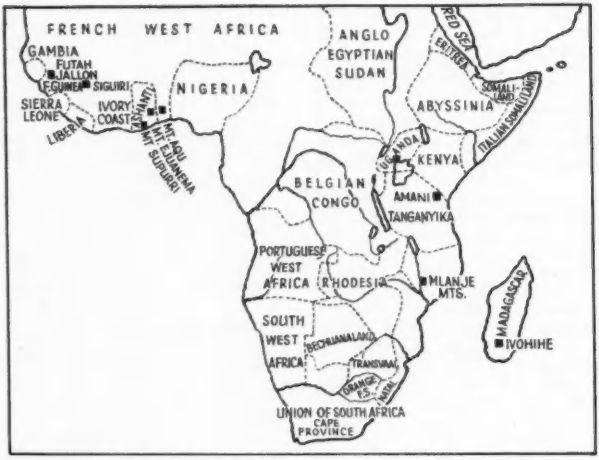
West Africa :

In this territory at Sefua, Janshin and Birrim, Mt. Ejuanema, Mt. Supirri, near Sefui Bekwai (estimated to contain 50 million tons),[7] Yenahin (said to be one of the largest deposits on the Gold Coast[8] (168 million tons), and a deposit west of Kumasi

which is also said to be very large, containing up to 180 million tons, all on the Gold Coast, and at Futah Jallor and Siguiri in French Guinea, lie what are thought to be the largest deposits of bauxite in the world,

amounting to over 200 million tons. So far, they have not been exploited to any considerable extent, owing probably to the fact that the European and South American deposits, more fully developed, were adequate for the needs of the industry and were generally more favourably placed in respect of cheap transport facilities.

These West African bauxites may well play an important part in the future of the aluminium industry, since, being located near the coast, they offer a potential source to the European aluminium producers, while on the other hand, the undeveloped water-power potential of the area (2,000,000 h.p. in the Gold Coast and Togoland, 3,000,000 h.p. in French Guinea, and 13,000,000 h.p. in Nigeria and British Mandate in the Cameroons) offers the possibility of an aluminium industry based on local bauxite and power with coal



imported from Great Britain or even from Nigeria.

South and East Africa :

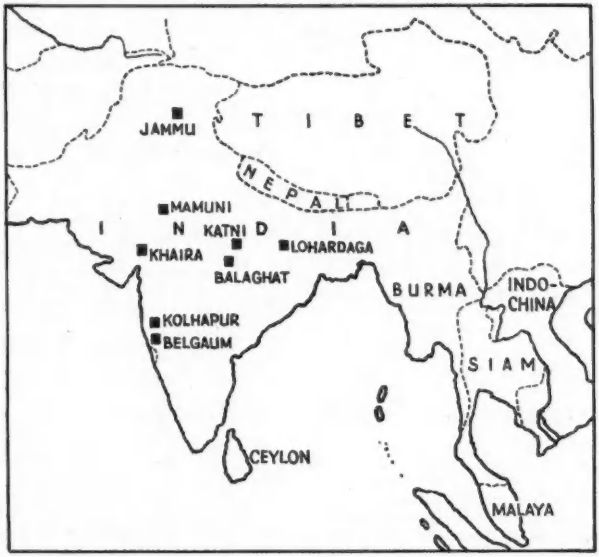
Deposits of bauxite are known to exist in Nyasaland on the Mlanje Mountains, in

Tanganyika at Amani, and in Uganda. The Nyasaland deposits are estimated to contain some 20 million tons. Although there are recorded, the total content of which is variously estimated at between 20[9] and 250[10] million tons. In spite of the many plans that were worked out for producing aluminium in India, none was made there before the war and, of that bauxite which was mined, 15,000 tons in 1937-38 was used for refining kerosene oil. Distance from aluminium plants in Europe and America appears to have prevented the economical export of bauxite.

TABLE 7

TYPICAL ANALYSES

	Nigeria	Sierra Leone	Gold Coast	Nyasaland	Tanganyika	Algeria	Madagascar	Seychelles
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
SiO_2	1.30	9.46	1.42	1.21	10.62	6.18	6.88	—
TiO_2	1.03	—	2.21	e	e	4.12	—	—
Al_2O_3	60.19	51.08	60.55	62.08	52.24	54.33	37.00	60.68
Fe_2O_3	3.91	14.14	9.75	4.00	4.26	21.74	30.80	9.56
H_2O	23.02	25.32	25.59	31.96	27.94	12.00	25.52	* 29.76 †



is coal in the neighbouring territory and an abundance of potential water power, considerable civil engineering development to permit continuous transport all the year round would be necessary before any commercial development could take place.

Asia

India :

The Geological Survey of India has pursued a vigorous policy in respect of bauxite resources with the result

Recently the first aluminium works in India came into production. Situated at Alwaye in Travancore, this subsidiary of the British and Canadian Aluminium Com-

TABLE 8

TYPICAL ANALYSES

	Belgaum	Kolhapur	Jammu	Jabalpur	Palaman	Ranchi	Kalelandi
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
SiO_2	2.11	3.44	21.40	1.18	0.99	0.36	1.37
TiO_2	5.95	7.00	4.05	8.80	12.00	17.24	—
Al_2O_3	58.81	59.35	60.65	60.23	60.66	49.72	67.64
Fe_2O_3	9.36	4.25	0.90	2.64	4.52	8.68	4.27
H_2O	23.76	25.00	11.00	25.40	22.24	22.20	26.80

panies draws its power from the Pallevasel hydroelectric scheme. It was originally intended to use Canadian alumina made from British Guiana bauxite for this plant. Owing to wartime transport difficulties, however, it was decided to make the alumina in India and a plant was erected for this purpose near Asansol in Bengal.

Australia

It was recently decided to manufacture aluminium in Australia, and the Government has set aside £3,000,000 for the purpose. Large deposits of bauxite occur in Australia but their grade is usually lower than that of bauxite mined in other parts of the world.[12 13] The highest grade deposits occur in Victoria where there are known to be many thousands of tons of high-grade ore.[14]

Dutch East Indies :

The East Indies are relatively new entries into the bauxite production field and have risen rapidly to a position of considerable importance. Production commenced in 1935 with 10,000 tons and by 1938 it had reached 243,000 tons or about 5 per cent of the total world production.

The known bauxite reserves of the Netherland Indies, conservatively estimated at 10 to 20 million tons, occurs in the Riau Archipelago, the most important deposits being on Bintan Island and the surrounding islets.[11] Bintan lies opposite Singapore. There are mines on both sides of the Strait of Kidjang at the south-eastern side of Bintan. Ore from the eastern side of the Strait is carried by ropeway to Sungei Kolak on the western side for washing and shipment.

Bintan bauxite shipped in 1936 had the following average composition :

Al_2O_3	...	...	53.00 per cent
SiO_2	...	...	13.50 ,, ,,
Fe_2O_3	...	...	1.20 ,, ,,

Later shipments, up to 1941, had a somewhat higher silica content.

Victoria :

Deposits have been tested in the Boolarra-Mirboo district and it is here that it is suggested the proposed aluminium plant be built. The deposits are said to be large, accessible, and of exceedingly good quality.[15] Moreover, the deposits are well located, being only 20 miles from the brown coal deposits, and the state electricity undertaking at Yallourn, and only some 80 miles from Melbourne.

New South Wales :

There are millions of tons of bauxite in New South Wales in the Inverell, Emmaville, Wingello, and Bundanoon. The Inverell-Emmaville deposits are of the higher grade, but, according to Dr. Raggett —Commonwealth Geologist[14]—the Wingello-Bundanoon deposits, although of lower grade, might be preferred to the others in New South Wales because of their nearness

to black coal, fabricating plants and shipping facilities. Published analyses of ore from the deposits in New South Wales give results varying between 25 and 68 per cent alumina, 2 to 39 per cent ferric oxide, and 0.16 and 20 per cent silica.

Tasmania :

Deposits of bauxite in Tasmania have been investigated recently at Ouse Campbell Town, Swansea, and St. Leonards. According to the Tasmanian Director of Mines,[16] the Ouse deposits offer the best advantages for immediate development. The other deposits may yield a large quantity of ore, but these have not yet been fully explored. The Ouse deposits are estimated to contain at least 2,000,000 tons and could be mined chiefly by open-cast methods, the overburden being only 3 to 6 ft. thick. There is coal of suitable quality nearby and a transmission line transmits power across the area.

Western Australia :

Large deposits of bauxite are said to exist in the Darling Ranges, near Perth, at Wongan Hills, and at Greenbushes, but their examination has been very limited.

Considerable interest has been shown of late in the alunite ($K_2SO_4.3Al_2O_3.6H_2O$) deposits of Lake Campion.[17] The deposit is a peculiar one consisting of a lake filled with alunite mud containing not less than 2,000,000 and probably more than 10,000,000 tons. This mud contains about 60 per cent of alunite. A plant has been erected for the recovery of a product containing 75 per cent sulphate of potash and 25 per cent sulphate of soda at a rate of 5000 tons per annum, and it is proposed to increase this output. The residue contains about 46 per cent alumina and 3 per cent silica. A pilot plant is being erected to try out the possibilities of recovering alumina from this residue, using hydrochloric acid generated in the potash plant.

(To be continued)

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German Aluminium Developments

OUTSTANDING developments in the German aluminium industry include continuous casting methods and the manufacture of "silumin," according to a report by the Office of Technical Services, Department of Commerce, Washington The report, "Technology of Aluminium and Aluminium Alloy Production in Germany; including Early Fabrication and Recoveries from Scrap" (135 pages), covers 23 German aluminium plants and research laboratories.

Continuous casting methods differ from extrusion methods in that the metal is actually cast into a specified shape instead of being forced through a die. Basically, continuous casting is accomplished by pouring a stream of molten metal through a simple forming mould into a tub of water. The process permits the molten metal to solidify to a predetermined cross-section and to any desired length.

Several continuous casting techniques have been developed in Germany during the past twenty years. The advantages of the technique are lower labour and equipment costs, reduced foundry losses resulting from trimmings, elimination of imperfect castings, and a reduction in the number of processes required to fabricate the metal.

"Silumin" is the trade name for aluminium and silicon alloys produced directly from kaolin by an electrothermal process. The process had been used in Germany since 1922 but was never developed into a large tonnage operation, according to the report. The process and the product are not supererior to similar developments in the United States.

During the war the Germans had to use much poorer bauxite than formerly. The reclamation of scrap metals accounted for one-fourth of German aluminium production.

A mixture of old and modern techniques characterises the German aluminium industry. The report contains information to the effect that the Germans made some use of the Bayer process "red mud" waste as ore for blast furnaces and as a catalyst in the Bergius process of making oil from coal.

Another report entitled, "Aluminium Hydrate and Alumina Production in German Factories" (16 pages), emphasises that the manufacture of alumina from which metallic aluminium is made by electrolysis was not technically efficient in Germany, despite lavish plant expenditures.

Sulphate of Ammonia

Continued Demand for Nitrogen Fertiliser

THE annual report of the British Sulphate of Ammonia Federation for the year June, 1945, to June, 1946, the first report for seven years, shows that the world demand for fertiliser nitrogen during 1945-46 was much greater than the available supply. The shortage was partly due to war damage to nitrogen plants, and partly to fuel difficulties.

Although war-time restrictions on publication of statistics have been removed, complete figures for the war years are not yet available, so that pre-war world consumption and production figures can only be compared with the year 1945-46. Table 1 gives comparative figures for the principal countries for the years 1937-38, 1938-39 and 1945-46.

It will be seen from these figures that consumption and production increased considerably in the U.S.A., Canada, Great Britain, Norway and Belgium, but decreased in Japan and Holland. In France, although consumption rose from 184,000 tons in 1938-39 to 220,000 tons in 1945-46, production had fallen in that period from 150,000 tons to 70,000 tons.

During 1945-46 supplies of nitrogen, phosphates and potash were apportioned between consuming countries and sources of supply designated by the International Emergency Food Committee set up by the United Nations.

High Output

Production of ammonia products and ammonia sulphate in Great Britain continued at a high level while home consumption was only about 14,000 tons short of the record year of 1943-44. Figures in Table 2 show the steady increase in the use of fertiliser nitrogen in agriculture in this country from the 60,000 tons in 1913-14 to the peak year 1943-44 when 665,280 tons were used on the land. The part played by sulphate of ammonia during the war years in providing extra food required from the lands of Great Britain, without which the country could not have been fed, is well shown.

Food Production

The increases in sulphate of ammonia consumption were due not only to the large increase in the area of land under the plough, but also to greater efficiency in the technique of crop production wherein fertilisers played a very important part. Consumption of nitrogen in the United Kingdom was trebled between 1939 and 1943, rising from approximately 60,000 tons in 1938-39 to 180,000 tons in 1943-44, whereas the increase in the area of land under crop during the same period was very much less, the total area of land under crop in 1939 being 8.8 million acres and in 1944, 14.6 million acres. Corresponding figures for cereals are 5.2 million acres in 1939 and 8.9 million acres in 1944.

It was realised from the beginning that yield per acre, as well as the number of acres under the plough, would play a vital part in maintaining food supplies. Much effort was made, both by official and commercial organisations, to bring about a widespread improvement in fertiliser usage with considerable success. One of the novel features introduced into this fertiliser drive was the Survey of Fertiliser Practice carried out by the official advisory chemists. From the results of this survey it was estimated that before the war two-thirds of the cereal crops throughout the country received no nitrogen fertiliser, whereas by 1942 about 69 per cent of the greatly increased acreage received the equivalent of 1¼ cwt.

TABLE 1.
Metric Tons of Nitrogen

	1945/46		1938/39		1937/38	
	Production	Consumption	Production	Consumption	Production	Consumption
Canada	179,000	21,000	49,500	10,000	51,500	9,500
U.S.A.	520,000	611,000	188,000	332,000	185,500	327,000
Chile	254,000	5,000	225,000	5,000	224,000	5,000
America other and West Indies ...	1,000	28,000	1,000	38,000	1,000	23,500
Australasia	7,000	17,000	6,000	14,000	4,500	15,000
Japan	80,000	80,000	425,000	419,500	416,500	454,500
China	10,000	10,000	1,000	30,000	1,000	28,500
India/Ceylon	6,000	45,000	5,000	29,500	5,000	26,500
Other Asia	—	8,000	—	44,000	—	42,500
Egypt	—	65,000	—	77,500	—	76,500
Other Africa	—	11,000	—	18,500	—	19,500
United Kingdom	248,000	166,000	128,000	68,500	135,000	68,000
Norway	91,000	23,000	85,000	11,000	85,500	10,000
Belgium	87,000	90,000	84,000	53,500	82,500	54,500
Holland	25,000	80,000	105,000	95,000	104,500	86,500
France	70,000	220,000	150,000	184,000	148,500	175,000
Other Europe (excl. U.S.S.R.) ...	300,000	400,000	1,090,000	1,026,000	937,000	975,000
TOTAL (excl. U.S.S.R.) ...	1,878,000	1,880,000	2,542,500	2,456,000	2,382,000	2,397,000

TABLE 2.

Production and Agricultural consumption of Sulphate of Ammonia in the British Isles.

	Tons of 2240 lbs.		Consumption expressed in Metric Tons Nitrogen		
Fertilizer Year	Total Production of Sulphate of Ammonia for Sale	Agricultural Consumption	Sulphate of Ammonia 20.6 N.	Nitrogen in Other Forms	Total Nitrogen.
1913/14	364,500	60,000	12,558	12,598	25,156
1914/15	360,000	65,000	13,604	9,449	23,053
1915/16	345,000	95,000	19,883	3,150	23,033
1916/17	300,000	144,600	30,264	787	31,051
1917/18	252,000	234,000	48,975	1,575	50,550
1918/19	310,000	269,000	56,301	3,937	60,238
1919/20	360,000	233,500	48,871	6,300	55,171
1920/21	316,000	166,920	34,936	7,480	42,416
1921/22	230,000	136,000	28,464	8,819	37,283
1922/23	345,000	140,200	29,343	8,976	38,319
1923/24	400,000	142,400	29,804	7,874	37,678
1924/25	412,000	153,200	32,064	7,275	39,339
1925 26	380,000	170,700	35,727	8,632	44,359
1926/27	325,000	171,800	35,957	6,488	42,445
1927/28	475,000	169,900	35,559	7,383	42,942
1928/29	650,000	190,700	39,913	9,940	49,853
1929/30	873,000	190,900	39,955	10,592	50,547
1930/31	556,000	164,200	34,366	10,570	44,936
1931/32	602,000	224,600	47,008	9,571	56,579
1932/33	599,000	238,200	49,854	7,514	57,368
1933/34	510,000	208,000	43,534	11,034	54,468
1934/35	434,000	209,600	43,868	13,307	57,175
1935/36	411,000	219,700	45,982	16,971	62,953
1936/37	478,000	224,400	46,966	18,710	65,676
1937/38	534,000	224,500	46,987	21,196	68,183
1938/39	490,000	215,537	45,111	23,537	68,648
1939/40	500,000	282,475	59,121	27,444	86,565
1940/41	534,000	473,854	99,176	33,707	132,883
1941/42	611,000	636,506	133,218	35,061	168,279
1942/43	710,000	639,010	133,742	38,423	172,165
1943/44	840,000	665,280	139,240	43,692	182,932
1944/45	733,000	615,110	128,740	45,325	174,065
1945/46 approx. ...	803,000	553,200	115,800	50,200	166,000

sulphate of ammonia per acre. In Northern Ireland as early as 1943 it was decided that a greater increase in food production could be obtained by an all-out fertiliser drive with a view to ensuring a general improvement in fertiliser usage, than by increasing further the acreage of land under the plough. As a result the consumption of sulphate of ammonia rose to nearly 40,000 tons in 1944, compared with 9000 tons used in 1939. During the same period the area of land under crop increased by less than 85 per cent.

War-Time Feature

A further interesting feature of the war-time fertiliser story is the increase in the ratio of nitrogen to other plant foods consumed as fertilisers. The ratio of nitrogen to phosphate increased from 1 : 2.9 in 1938-39 to 1 : 1.9 in 1943-44. During this period the nitrogen content of compounds was raised from an average of about 3.5 per cent to 5.25 per cent.

It was decided to concentrate on a campaign to convert farmers to the practice of silage making. The organisation of this scheme was rapid and efficient, and at a later stage was taken over as part of the Ministry's own general production campaign. This campaign enabled the efficient utilisation of many thousands of tons of sulphate of ammonia on grassland.

The increase in the top-dressing of cereals with nitrogen is further evidence that pre-war propaganda and demonstration has borne fruit. The research and development work done by the I.C.I. research station at Jealott's Hill demonstrating the value of this practice had been accepted by most of the cereal growers in pre-war days, but economic conditions before the war had militated against widespread practice.

Exports

The principal shipments of sulphate of ammonia from the United Kingdom for some of the last seventeen fertiliser years are shown in Table 3. From the outbreak of war overseas shipments could be made only under export licences issued by the Board of Trade. In view of the growing requirements of the home market, shipments were for a time suspended entirely except for special Government purposes. By March, 1944, production, which was reinforced by the operation of the Ministry of Supply factory at Prudhoe, exceeded home market requirements and exports on a substantial scale, were resumed..

At the outbreak of the war it was agreed with the Ministry of Supply that home prices would be increased to meet increased costs of production and distribution due to the war. Subsequently the Ministry of Supply decided to "peg" prices at the 1940-41 level (£9 10s. per ton), and to grant producers a subsidy on home agricultural

TABLE 3.
U.K. Exports of Sulphate of Ammonia.
Fertilizer Years ended 30th June.

To	1929/30	1935/36	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46 (Est.)
Holland and Belgium ...	—	684	5	—	—	—	—	—	10,718	4,871
France ...	43	—	—	—	—	—	—	—	14,617	19,981
Portugal ...	7,711	11,519	19,428	2,079	—	—	—	—	9,828	—
Spain	194,205	8,121	5,842	3,846	9	—	—	—	—	—
Italy	4,878	—	—	—	—	—	—	—	4,444	—
Other Europe	22	476	499	306	300	100	501	510	4,186	9,918
Palestine ...	925	748	2,002	723	—	—	—	11,178	10,024	4,570
India & Burma	23,881	53,158	66,027	46,497	—	—	—	10,305	53,342	130,795
Ceylon... ...	13,431	5,462	18,257	18,807	—	3,967	8,633	1,500	28,977	32,813
Malaya and British Borneo	2,625	8,688	23,880	17,662	—	—	—	—	—	782
Dutch East Indies ...	30,522	876	221	—	—	—	—	—	—	—
China and Hong Kong ...	109,888	12,221	33,761	—	—	—	—	—	—	1,105
JapaneseEmpire	158,971	201	—	—	—	—	—	—	—	—
Canaries ...	19,464	13,614	12,392	176	—	—	—	—	—	—
Egypt	1,751	501	2,428	1,960	1	—	—	13,822	28,323	8,708
South Africa and Rhodesia	1,986	8,511	16,818	15,635	—	—	7,950	—	8,013	2,851
Mauritius ...	6,688	12,529	10,258	15,875	—	11,703	—	—	6,471	—
Australia and New Guinea...	9,960	26,120	35,552	27,841	—	—	—	—	1,960	23,368
New Zealand ...	10,123	4,514	4,860	3,348	40	40	—	1,218	—	—
British West Indies ...	3,745	13,273	15,550	22,722	—	—	8,038	15,012	12,294	14,454
British Guiana ...	5,830	8,776	11,043	14,339	—	—	—	6,161	6,634	12,079
Eire	19,264	26,801	28,929	38,213	18,385	29	—	640	2,129	1,711
Total exported	654,973	227,782	321,868	237,727	22,939	18,627	30,202	60,684	206,450	274,589

sales to cover increases in costs not included in the price.

The average prices to members per ton produced were :

	For 24½ per cent. Ammonia	For 25½ per cent. Ammonia Neutral
	£ s. d.	£ s. d.
1917/18	16 7 3	—
1919/20	22 13 3	23 15 3
1923/24	11 19 11	13 5 11
	For 20.4 per cent. Nitrogen	For 21.1 per cent. Nitrogen
	£ s. d.	£ s. d.
1924/25	10 18 0	12 5 6
1931/32	3 7 10	3 18 10
1936/37	4 7 7	4 18 7
1939/40	6 19 10	7 11 3
1940/41	7 14 11	8 7 7
1941/42	7 16 5	8 9 1
1942/43	7 16 4	8 9 0
1943/44	7 17 5	8 10 1
1944/45	8 13 1	9 5 9
1945/46	9 1 11	9 14 7

In the years of propaganda for sulphate of ammonia, says the report, knowledge and truth have been kept clearly in view. In the early days the value of sulphate of ammonia as a single fertiliser for a number of specific purposes was stressed. This sometimes resulted in it being used in the wrong conditions, and a certain amount of unfortunate and generally unjustfiable prejudice was thus created against ammonium sulphate. Investigations at Jealott's Hill into the relations between nitrogen, phosphate and potash gave knowledge of their mutual value and use, so that propaganda is now on the lines of the use of ammonium sulphate in a balanced scheme adjusted to crop requirements.

Lectures, often illustrated by instructional films, field demonstrations and other methods were used to bring home to 400,000 farmers the value of nitrogen.

In the past nitrogen has been used mainly on tillage crops. In future grassland will play an increasingly important part in our economy. Accordingly the Federation has set up an organisation to carry out a long-term investigation into grassland problems.

POLYSTYRENE PLANTS

One of the factors that has been responsible for the limited supply of polystyrene in Canada has been the lack of facilities in the Dominion for the production of this material, widely used in the plastics industry. Added to this has been the stringent supply situation in the United States and, all in all, the quantities of this material available to Canadian manufacturers has been limited, to say the least. A reversal of this situation is expected with the completion of two large polystyrene works in the Dominion and they are expected to contribute materially to the further development of the Dominion's plastics industry.

Both of the plants are located in the eastern part of Canada, with one situated in Ontario and the other in Quebec. The Quebec plant has been operating at 50 per cent of capacity and was scheduled for full production by January 1, 1947. In addition to increasing native supply of polystyrene, plans are being formulated, as well, to develop Empire export markets.

Accidents with Explosives

War Reports Released

THE results of seven years' study of the causes of accidents in the manufacture and industrial uses of explosives—seven years in which the manufacture of high explosives in this country reached its highest peak—are set out in detail in the seven annual reports of H.M. Inspectors of Explosives (Cmd. Nos. 6976-6983, 1939-1945) just issued as White Papers by H.M. Stationery Office (sixpence net).

Viewed as a whole, the story told of these years is not discouraging. The number of accidents in the years of full war production necessarily increased, but the increase was far smaller than the great expansion of explosive manufacture might have warranted. The number of accidents in 1945, the last year reviewed, was down to the peacetime level, 156 in manufacturing and only two in handling, in which four people were killed and 30 injured. These figures afford a strikng contrast with the preceding year (1944), when accidents in manufacturing alone totalled 352, involving the deaths of 17 and injuries to 86. Corresponding figures in the previous year covered by the reports were: 1943: 634 accidents; 10 killed, 63 injured. 1942: 629 accidents; 15 killed, 152 injured. 1941: 480 accidents; 20 killed, 95 injured. 1940: 328 accidents; 11 killed, 86 injured. 1939: 123 accidents; 30 killed, 102 injured.

Needless Destruction

These figures, however, do not tell the whole story of destruction inadvertently caused by explosives. The account is greatly increased by the category "Use and Miscellaneous" which accounted annually for approximately 300 accidents (311 in 1945), more often with fatal results than those occurring in manufacture. The reasons for this are referred to by the inspectors, indicating that a much more rigorous system is required to avert the calamities due in most cases to unauthorised or careless handling of explosives.

The total of accidents in manufacturing establishments is seen to be far less serious than the figures would suggest because, of the 156 in 1945, 80 were relatively innocuous, caused by pressing detonators behind protective shields and resulting in no injuries to those concerned. This in itself represents a testimonial to one at least of the safety measures which the explosives industry has evolved and throws into relief the much more lethal results of explosions where none of the industrial safeguards obtained.

One of the principal changes in 1945 in legislation concerning explosives was the decision in September to reintroduce (as from January 1, 1946) the pre-war limit of 100 lb. of explosive (Classes I, II, or III) which may be conveyed by a mechanically-driven vehicle. Another important indication of the return to peacetime conditions was the close study by the Inspectors in 1945 of safety distances for the bulk storage of explosives (15 tons and over) previously set out in the Guide to Explosives Acts. A revised list of scheduled explosives, omitting many obsolete materials formerly listed, has been prepared and definitions agreed with manufacturers and importers. Throughout the war, the permitted distances observed by the Services differed from those set out in the Guide to the Acts, and it was obviously wrong, says the report, that two different tables should be in existence, one for government explosives and one for industrial explosives.

A sub-committee has now reviewed the existing tables and recommends:—

(a) Common set of outside safety distances should apply to the Home Office and Service storage areas in Great Britain and Northern Ireland.

(b) Outside distances should provide protection for the ordinary type of dwelling houses against major structural damage. This excludes such damage as broken windows, damaged ceilings, dislodged chimneys or loose slates.

(c) The outside distances should be given under two headings, viz.:—

1. Inhabited buildings.
2. Main roads, railways, and Service establishments.

From a study of bomb incidents during the war the Research and Experiments Department had devised a formula relating the average radius of damage with the weight of explosive involved. Based on this, a table of outside safety distances was drawn up and has been provisionally adopted for quantities exceeding 30,000 lb. These distances are considerably less than the old ones and do not purport to give complete protection against major damage to property.

Causes and Effects

The most valuable aspect of the seven reports from the viewpoint of the industrialist is the study they provide of the causes and effects of individual accidents, of which the outstanding example was at Fauld's Bridge, Burton-on-Trent, in 1944, which the report for the year describes as "by far the largest explosion ever to have occurred in these islands"—when 3000 tons of explosive contained in R.A.F.

bombs detonated. Killed and missing numbered 68 and 22 were injured. Considering the enormous amount of explosive involved, the loss of life was light. A crater was left some 300 yards in diameter and damage extended 1400 yards.

Among the several other analyses of individual accidents, the 1945 report studies three which occurred in the same nitroglycerine factory, two of them in the denitrating process. The first is attributed to a fall, through leakage, of the level of the acid in the nitroglycerine waste acid storage tank, resulting in a "tail," which is normally drowned, running into a feed box and a small quantity of liquid explosive running into the denitrating tower where an explosion took place. In the second incident steam being employed to cleanse the waste acid storage tanks caused the explosion of a small quantity of nitroglycerine which had lodged either in the tower or in the feed box. A much larger explosion at the same factory—involving 1500 lb. of nitroglycerine—occurred in the nitrating process. No cause can definitely be attributed but (says the report) it is possible that an old piece of sacking dropped into the nitrator lantern, or water squeezed out of the sacking into the lantern may have set up the decomposition. The firm has now replaced the batch method of nitrating by the Schmidt continuous nitration process.

An accident with a nitro compound, in this instance a blasting cartridge, of a less involved kind occurred in a steam-heated waxing tank in which cartridges were dipped. Here the cause of explosion seems to have been that a 2½ lb. cartridge was inadvertently dropped to the bottom of the tank and overlooked and the heat of the steam decomposed the explosive. The tank and the roof were extensively damaged but no one, fortunately, was in the building at the time. Now all waxing tanks at this works are emptied daily and certified as empty by the foreman of the packing house.

Fatal Spark

The familiar danger of ignition by a spark generated by a metal weighing machine had another example when some 400-500 lb. of dry milled smokeless "Diamond" composition took fire while being weighed into charges. The operative was badly burned. Contact between the brass scoop of the weighing machine and some composition on the platform is thought to have caused the spark. Security measures since adopted by this firm are: the weighing is now carried out in a more suitably located compartment, and is done on an oil-immersed machine with a visible recording; a light scoop of wood or soft aluminium is used; metal bogies are not admitted to the working rooms of this building. Among the highly sensitive explosive compounds, fulminate of mercury was responsible for two minor explosions arising from workers treading on tarmac which had been contaminated with traces of the fulminate which either escaped from barrels or the washing department. In the same class was the explosion of some 8000 fog signal percussion caps which a worker was sieving in a brass wire net sieve into a box of oil-moistened sawdust to remove any loose composition. All the caps were involved and the worker, who had been orally instructed that not more than 1000 caps were to be sieved at one time, was fortunate to escape with comparatively light injuries. As a result of a similar accident at the same factory in 1944 the Inspectors had recommended that all such sieving should be done mechanically behind a screen. This is now done and written instructions have been issued to operators.

Faulty Machine

Faulty mechanism was a contributing factor to an accident in another section of the explosives industry which cost the lives of two men operating two hand screw presses pressing stars for fireworks. These thin tin sleeves were filled with loose combustible composition containing a chlorate and compressed in a steel mould fitting loosely on to a steel mould plate on the bed of the press, under a load of about 2½ tons. After the explosion a burnt-out green star which had been compressed unevenly at one end was found on the bed of the press. Bad centreing of the mould or the star, causing excessive friction between the steel punch and the steel mould was probably the cause of the tragedy. The use of screw presses has now been discontinued. Seven other accidents in fireworks factories reported during 1945 were of a minor character.

Of the six accidents associated with acetylene in 1945 four were caused by dissolved acetylene (two by fire and two by explosions of cylinders) and two by low-pressure acetylene generators, in one of which, an explosion during cleaning operations, a man lost his life. The circumstances and possible causes of these accidents varied widely. It is encouraging, however, to note that useful development work is being done by the Home Office Section, Armament Research Department, Woolwich on the pressure flow relationship of low pressure (up to 10 in. water head) hydraulic back-pressure valves and a new method was formed for assessing their ability to arrest flashbacks. As a result, recommendations have been made for modifications in design to improve the safety factor. A back-pressure valve suitable for small dissolved acetylene cylinders has also been designed, but its full potentialities had not been determined when the 1945 report was prepared.

Careless handling of petrol was again a

potent source of accidents, 25 having been reported to the Inspectors in 1945. Eleven were fatal. The report notes with satisfaction that the number was smaller than in 1944 and substantially smaller than in 1937 and 1938, when there were 71 and 46 respectively. Two persons lost their lives when a store of petrol accumulated by an innkeeper from the basic rations of three cars ignited when he was transferring spirit from a ten-gallon drum. Another accident occurred in similar circumstances and in both cases proceedings were instituted for offences under the petrol storage regulations.

Possibly the best summary of recent experience in the causation of explosions of nitroglycerine and on accidents in general is derived from the report of the Chief Inspector of Explosives, Canada, on an explosion in a gelatin cartridge building of some 400 lb. of material, with the loss of three lives. The disaster is believed to have resulted from rough handling of a box of scrap powder. The Canadian Inspector recommends: (1) That the use of wooden boxes for rough powder should be discontinued and that a heavy cardboard box similar to a gelatin dough carton should be used and discarded at the end of each day; (2) That employees do not realise that the majority of accidents . . . are in all probability caused by some unsafe but otherwise insignificant act on the part of the operator . . . To this end it is recommended that a condensed report, giving possible causes of past accidents in explosives buildings be permanently posted in changing houses, so that both old and new employees may have the opportunity of reading and comprehending that the apparently unimportant "little jobs" require just as much care as the operating of a machine.

One of the most disturbing features of all the annual reports, of which the 1945 report reviewed here is typical, is the number of needless fatalities and injuries to individuals, usually boys, who need never have been exposed to such risks. In each of the war years the finding of lost or neglected military explosives led to a long record of death and injury. Now, fortunately, the total is diminishing, the Inspectors estimating there were in 1945 143 such accidents (53 fatal) compared with 246 (124 fatal) in 1944. But as accidents from "trophies" from the 1914-18 war are still being reported, the Inspectors fear further future tragedies from battlefield finds of the last war which are brought into homes and left carelessly lying about.

Wholesale Prices in 1946

WHOLESALE prices, as measured by the Board of Trade index number, showed much more activity during 1946 than in any year since 1940, when price control began to be fully effective. The rise of 6.2 per cent between December, 1945, and December, 1946, was the cumulative result of an almost unbroken upward movement throughout the year. The rising cost of imported raw materials had widespread effect on prices in this country, as illustrated by the contrast between the fall of nearly 1 per cent in food prices, heavily subsidised, and the rise of 10 per cent shown for industrial materials and manufactures, where subsidisation is of much less importance. Among the various groups for which wholesale price index numbers (average for the year 1930—100) are listed by the board of Trade, that of chemicals and oils showed a figure of 158.6 for December, 1946, compared with 144.3 for December, 1945. The average index number in respect of chemicals and oils for 1946 was 148.3, as compared with 94.7 in 1938.

The principal changes among "chemicals and oils" were increases of 36 and 63 per cent respectively, in December in the average prices of refined groundnut oil and crude palm kernel oil, these being the only changes recorded for these commodities. White lead paint, which advanced in price several times during the year, was nearly 35 per cent higher in December, 1946, than at the end of the previous year, while varnish rose by 30½ per cent. Other increases recorded were in respect of lubricating oil (9 per cent), coal-tar products (5½ per cent) and general chemicals (4½ per cent). On the other hand, there was a reduction of about 15 per cent in the price of fuel oil, following the changes in October in the zonal price system and the subsidy of 1d. per gallon to consumers. Prices of drugs were also lower on the average by about 2 per cent.

Silicon Carbide Articles

ACCORDING to Canadian Pat. 435,119, which has been granted to A. H. Heyroth, a new approach to the manufacture of silicon carbide is offered. Under the new method, a mixture of glycerine and an acid with furfural, furfuryl alcohol, or both, is placed in a mould and a reaction then occurs to form a porous body composed mainly of carbon; a substantial amount of the carbon being a continuous skeletal strucure. The porous body thus formed is removed from the mould and dried. It is then impregnated with silicon, either by contact with molten silicon, or by penetration of silicon vapour into the pores of the moulded carbon body.

Gasworks Effluents*

Methods of Utilisation and Disposal

THE type of carbonising plant exercises a marked influence on the composition of ammoniacal liquor. Further, the liquors obtained from the several parts of the plant show important differences. Thus, although little condensation occurs in the retort house, the liquor circulated through the hydraulic mains becomes rich in the less volatile substances (notably ammonium chloride and higher tar acids), and low in the volatile ammonium salts. The gas entering the condensers should contain little tar and, therefore, the liquor condensed there should contain only small quantities of higher tar acids, since these, being non-volatile in steam, condense with the tar.

Similarly, the fixed ammonia is low. The concentrations of free ammonia, carbonate, sulphide and phenols are, however, relatively high. The ammonium compounds still in the gas leaving the condensers are removed in the scrubbers, the liquor from which contains the bulk of the free ammonia, carbonate and sulphide. A little cyanide is also commonly present. The thiocyanate and thiosulphate found in this liquor are not primary products, but are formed by oxidation of the original sulphide and cyanide. Their concentration, therefore, depends on the opportunities available for this oxidation to occur.

Treatment to Avoid Waste

In the past, the ammonia contained in ammoniacal liquor was generally recovered as sulphate. With the rise of the synthetic ammonia industry, however, this, in the case of small and medium-sized works, ceased to be profitable, except in isolated instances. At some works the ammoniacal liquor was even run to waste. The committee strongly deprecates such wastage of ammonia. The economics of sulphate manufacture and the possibilities of other methods of treatment have, therefore, been closely considered.

The solution recommended by the committee is the production of saleable ammonium compounds at central works, the cost of transport to these being kept low by the concentration of the liquor before despatch. For this concentration automatic plants, which are inexpensive and easy to operate, are available. Generally, these convert the ammoniacal liquor into a concentrated gas liquor containing some 15 to 24 per cent ammonia, together with considerable quantities of carbonate and sulphide and some phenols, and a spent liquor containing the fixed ammonium salts, the higher tar acids and the bulk of the phenols. Considerable numbers of these plants are now in successful operation, and the problem of liquor disposal is thus simplified, sometimes with financial advantage.

For certain works another possible method of utilisation exists. Ammoniacal liquor has been shown to be a useful nitrogenous fertiliser if applied at a suitable time and in correct dosage, and, where a works is so situated that the liquor as such can be used locally without heavy transport charges, this may provide a useful outlet.

Phenol Extraction

Of the other constituents of liquor only the phenols are likely to be extracts at a possible profit. The known methods of recovery were studied in the earlier work of the committee, and it was found that the process in which the phenols were washed out by benzole was the most widely used. Benzole, however, is not an ideal solvent. Its solvent power is low, and loss by volatilisation and solution in the liquor was high. Alternative solvents were considered, in particular tricresylphosphate and certain dephenolated tar oil fractions. Both of these have an improved solvent power, and loss by volatilisation and solution in the liquor was low. There were, however, difficulties. Tricresylphosphate became contaminated in use, while the tar oil fractions were not easy to prepare. Since then the new "Phenosolvan" process has been developed. In this the phenols are recovered by solution in a mixture of aliphatic esters termed "Phenosolvan." This has a high solvent power for phenols, and its boiling-point is less than that of the recovered phenols, so that it does not become contaminated in use, being recovered after each treatment in pure form. Further investigation is being made of the suitability of various solvents for the recovery of phenols from ammoniacal liquor.

Except where all the liquor is used as a fertiliser, there remains, whatever treatment is given, the problem of the final disposal of spent liquor. The recognised methods available are: (1) Evaporation; (2) Direct discharge into a suitable body of water; (3) Discharge into the sewers for treatment in admixture with sewage at the local sewage works.

Of these three methods, evaporation should only be used when no better alternative presents itself. It is apt to be expensive, and may cause trouble due to corrosion and aerial pollution. Should it be used, an important consideration is that the volume of the liquor should be a minimum, and methods for achieving this have

* From the 8th Report of the Liquor Effluents and Ammonia Committee of the Institution of Gas Engineers (Communication No. 304)

been described in reports of the committee.

Direct discharge to surface waters is not usually permissible in view of the very polluting character of the liquor. Phenols and higher tar acids are particularly undesirable in water which is to be used as a source of domestic supply, since when chlorinated these substances impart an unpleasant taste to the water, even when they are present in very minute concentrations. Damage may also be done to fisheries by discharge of gasworks liquor, both as a result of de-oxygenation of the water and of the direct toxic action of some of the constituents of the liquor. The principal toxic substances are the phenols and higher tar acids, which may severely affect fish when present in concentrations above 1 part per 100,000.

Where, however, sufficient dilution is possible, as in the case of discharge into the sea, this method provides a simple solution to the problem. Care must be taken, however, to avoid high local concentrations of liquor and perhaps the best method of achieving this is to discharge the liquor into the local sewers, where preliminary dilution with sewage takes place. Clearly de-phenolation, particularly if accompanied by some measure of removal of the higher tar acids, would be of material assistance in this method of disposal.

Legislative Control

The third method is that most strongly recommended by the committee. The discharge of liquor to the sewers in England and Wales (excluding London) is now governed by the Public Health (Drainage of Trade Premises) Act (1937), which came into force on July 1, 1938. This Act does not affect the right of gas undertakings to discharge into the sewers effluent of the same composition and quantity as that discharged before March 3, 1937.

With regard to new or increased discharges, however, the Act provides that traders may discharge effluents into the sewers either (a) in accordance with by-laws made by the local authority or (b) by agreement with the local authority. It is thought that some local authorities, while not making any by-laws under the Act, may suggest that gas undertakings should enter into agreement with them, and endeavour to insert in such agreements provisions similar to those frequently imposed by by-laws. The committee wishes to call attention to the fact that no gas undertaking is compelled to enter into such an agreement with the local authority, but is, on the other hand, entitled to request the Ministry of Health to call upon the local authority to make the necessary by-law. Where an agreement is suggested, or as soon as notice is received that a local authority proposes to make by-laws, the committee recommends that the gas undertaking should communicate with the secretary of The Institution of Gas Engineers, since the committee particularly desires to consider such by-laws and any proposed scale of payments, so as to avoid any prejudice to the general interests of the gas industry.

Investigation has shown that, in a normal case, where the areas served by the gasworks and the sewage works are congruent, the percentage of spent liquor in the sewage will not exceed about 0.4 per cent, and that with this mixture no difficulty should be experienced in treating the liquor. In this country, sewage, after removal of the suspended solids, is commonly purified by biological oxidation, either in percolating filters or by activated sludge plants. Experiments on the behaviour of the separate constituents of spent liquor have shown that :—

(1) Fixed ammonia may or may not be completely oxidised, depending upon the capacity of the plant. If oxidation is incomplete, the oxygen demand of the effluent will be increased, with a corresponding deterioration in its quality.

(2) Phenols are very readily oxidised.

(3) Higher tar acids and thiocyanate are the most difficult to treat.

(4) Thiosulphate may usually be neglected, as its concentration is low; and, moreover, since it is formed in an analogous manner to thiocyanate, any steps taken to reduce the concentration of the latter will also affect that of the thiosulphate.

Disposal with Sewage

Clearly, the most suitable spent liquor for disposal in admixture with sewage is one containing the minimum possible amounts of higher tar acids and thiocyanate. Reducton of this latter substance will also reduce that of the fixed ammonia, with consequential benefit. The content of higher tar acids depends largely on the degree of contact between the liquor and the tar, and, therefore, there should be complete and early separation of the two.

One method of securing this is by the use of an electrical de-tarrer in the hot gas, coupled with complete isolation of the retort house liquor from the scrubber and condenser liquor. From what was said above, it will be seen that by this means only the retort house liquor will contain higher tar acids, and it is possible to deal with this separately. It may be used as a fertiliser, or evaporated with or without recovery of the ammonium chloride contained in it. The latter treatment may, if necessary, be carried out after conveyance of the liquor to a central works.

It has already been stated that the content of thiocyanate depends on the extent to which the liquor has undergone oxidation. The committee therefore recommends that air for purification should be admitted, not

at the inlet to the condensers, but at the inlet to the purifiers. Further, the time of contact of the scrubbing liquid and gas should be the minimum consistent with removal of the ammonia, and if liquor is used as the scrubbing medium, then its initial sulphide content should be as low as possible. Thiocyanate formation can also be reduced by the separate recovery of cyanide for sale as thiocyanate.

Liquor-Sewage Ratio

For efficient treatment of liquor in admixture with sewage the ratio of the one to the other should remain substantially constant. This is particularly necessary where thiocyanate is to be oxidised, since this process requires the presence of a special strain of bacteria, and these cannot flourish with sudden variations in the proportion of liquor to sewage.

Crude ammoniacal liquor can be treated in admixture with sewage, but with greater difficulty than spent liquor. The proportion which can be tolerated is less, and even so the degree of purification is smaller. This is mainly due to the presence of sulphide and a larger proportion of ammonia in the "free" state. These substances are removed by distillation, and the consequent improvement in the case of treatment of the liquor is so pronounced that the committee considers distillation the best single means at present available for facilitating the disposal of gasworks liquor.

A striking example of what can be achieved by the application of these recommendations was given by Mr. A. B. Britton (engineer and manager of the Hinckley Corporation Gas Undertaking), in his presidential address to the Midland Association of Gas Engineers and Managers, on March 15, 1945.

The problem at Hinckley was peculiarly difficult in that 40 per cent of the flow at the sewage works was composed of dye wastes, and thus, with a normal vertical retort liquor, it was not possible to treat more than a trace in admixture with the sewage. The liquor, therefore, had to be removed by rail tank-cars to chemical works at a considerable expense.

Economy Effected

Following the committee's recommendations, the following alterations were made at the works: an electrical de-tarrer, to treat the hot gas, was installed, and the retort house liquor was isolated from the main bulk. This retort house liquor, rich in higher tar acids and ammonium chloride, is not passed into the sewers. Prior to the war it was sent by tank-car to Birmingham, but it is now disposed of locally as a fertiliser. The thiocyanate content of the main bulk of the liquor was greatly reduced by the installation of a small blower to pass the air for purification into the gas at the inlet to the purifiers. This liquor was distilled in an automatic concentrated-liquor plant, and the effluent finally passed to the sewer was of such an improved character that no trouble has been experienced in treating the whole of it at the sewage works. Moreover, Mr. Britton pointed out that these alterations had resulted in a saving of about 0.35d. per therm of gas sold.

German Technical Reports

LATEST technical reports from the Intelligence Committee in Germany include the following, copies of which are obtainable from H.M. Stationery Office at the prices stated.

BIOS 527. Iron, steel and non-ferrous metal works plant and machinery (10s. 6d.).

BIOS 941. *Gesellschaft für Teerverwertung, Duisberg-Meiderich*: Tar distillation (3s.).

BIOS 945. Production of beryllium at "Degussa" plants (1s.).

BIOS 964. Manufacture of potassium permanganate at I.G. Farben factory, Bitterfeld (3s.).

FIAT 38. Investigation of insecticide and insectifuge research and manufacture in Western Germany (2s.).

FIAT 295. Lithium extraction and uses (3s.).

FIAT 481. *Reicchswerke Hermann Goering A.G., Linz, Austria*: Coke and nitrogen plant (3s. 6d.).

FIAT 850. English translation of "The Preparation of Mepasin-Sulphinate and Mepasin-Mercaptan" (6d.).

FIAT 851. English translation of "The Ignition of Chloranil-Alkali-Hydroxide Mixture by Water" (1s.).

FIAT 853. English translation of "Reaction of Cyclic Vinyllactams with Phenols" (6d.).

FIAT 854. English translation of "Preparation of Mixed Polymerisation Products of Vinylsulfones" (1s.).

FIAT 898. Redix systems in emulsion co-polymerisation of butadiene (75) and styrene (25) (1s. 6d.).

The following evaluation reports are also available.

BIOS E/R 16. *Zipperling Kessler and Co.*: Shellac, tannin and dyestuffs.

BIOS E/R 18. *Stroever and Co.*: Shellac.

BIOS E/R 395. (a) *Herr Hans Malmberg*, (b) *Possehl Erz und Chimikalian Handelgesellschaft. G.m.bH.*: Mica merchants.

Coal Shortage Cuts Production

Famine Conditions in the North-West

By a Staff Reporter

LIVERPOOL:

WHILE future allocations of coal were last week-end a source of anxious conjecture to industrial executives all over the country, one essential section of the heavy chemical industry was facing a crisis, and the future operations of many ancillary undertakings whose fate is bound up with it were unpredictible. Conditions in the steel and metal industries were equally critical and the official announcements published early this week have confirmed forebodings in those sections. This is the direct outcome of the coal famine conditions which have persisted since last autumn, hardening rapidly as winter heightened the demand for fuel from all directions and the inadequate coal production figures enforced cuts in deliveries to all consumers.

Coal Stocks "Negligible"

The outstanding example of the critical situation to which the virtual breakdown of coal supplies to heavy industries has given rise is the vast centre of alkali production which Imperial Chemical Industries (Alkali Division) operates near Northwich, Cheshire, where THE CHEMICAL AGE was told last week-end that coal stocks were "negligible" and the scale of future production, or even its continuance, was as unpredictible as the scale of the "re-allocations" promised by the fuel authorities. The management of this vast chemical undertaking was constantly in contact with the local and national representatives of the Ministry of Fuel and Power and had not then received any assurance that the scale of future allocations would be sufficient to retrieve the situation. No definite information could be obtained and the authorities appeared to be as much in the dark as the consumers were. There had, however, been no lack of co-operation from the Ministry of Fuel and Power.

How critical the situation is is evidenced by the latest figures of production of soda ash—the vital factor in hundreds of chemical and industrial processes—by the I.C.I. Alkali Division. This had been unavoidably reduced to 35 per cent of the output in November, when output was already being diminished parallel with the falling coal supplies. The Alkali Division was on January 6 obliged to institute a rationing system under which at one time users of soda ash were receiving 50 per cent of their normal requirements. Last week the Alkali Division warned its customers that a curtailment to 25 per cent was possible if fuel supplies were not maintained or enhanced. That, THE CHEMICAL AGE was told at Northwich, had not yet been forced upon them and production last week was around 50 per cent of normal; but there was no certainty that that, or indeed any substantial production figure could be maintained.

Exports Stopped

The substantial exports of soda ash, of which for so long I.C.I. had been the sole sourse, are, of course, at an end. Thus one most potent weapon in the contemporary export drive has been immobilised, and the activities of a number of dependent exporting industries have been severely limited. In this connection it was emphasised that the importance of soda ash was out of all proportion to the quantity employed. Even those who purchased as little as one or two tons required to scour boilers or similar plant could be put out of production were that supply not available.

"So far," said an official of the Northwich works, "we have been able to keep all our people at work by a judicious redistribution of labour, aided by the fact that we have seven years of maintenance arrears and repairs to make good. But this, you will appreciate, is only a short-term policy." If the shortage continued it would be impossible to maintain the labour force at the present level.

Poor Quality Fuel

Dealing with how the situation had arisen, the official at Northwich confirmed what had been said by other chemical manufacturers in the North Western area: that coal allocations in the past had provided no basis upon which future programmes could be planned, as receipts had borne little relation to entitlements. "You cannot run a plant like this (the size of a small town with a labour force of several thousands) on allocations," he said. A further limiting factor had been the poor quality of coal received under the pooling system. This subject was trenchantly dealt with recently by a correspondent of the *Daily Telegraph*, according to whom 25 per cent of industrial coal now being delivered consisted of non-combustible material, which was placing a new burden on the limited supply of labour and transport. At Northwich, the proportion of waste was stated recently to have repre-

sented an 8-10 per cent reduction in calorific value. The effect of this was more limiting than the figures alone indicated, because a chemical plant using poor fuel showed a lower output for the same unit of heat.

The records of recent coal deliveries indicated that the most favourable was 75 per cent of the Northwich allocation and was now "infinitely lower." To receive 45 per cent of the allocation had been a common experience. One of the problems associated with the new allocations, it was anticipated, would be the inability of Government departments to adjudicate realistically between the rival claims of different industries. A disturbing feature of the prevailing system of fuel distribution had been the failure to build up stocks by judicious allocation in summer when domestic requirements were lowest and a policy of "free for all" had prevailed. With foresight then, the present acute shortage might have been averted.

A very similar state of affairs was reported at the General Chemicals Division, I.C.I., at Cunard Building, Liverpool, where the view was expressed that the heavy chemicals industry had for the moment saved the situation—or at least averted disaster—by juggling with the dwindling supplies of fuel and by the redistribution of labour. The General Chemicals Division had managed to keep going without turning off workpeople, but recent shortages had rendered abortive any plan for raising production to keep pace with industrial users' needs.

A slightly better situation was reported to exist at the Salt Division, I.C.I., at Liverpool, due possibly to the fact that as a branch of food industry it is liable to receive preferential treatment.

All Industries Affected

That few, if any, industrial coal users in the North West had escaped the effects of the present shortage was indicated by replies received by THE CHEMICAL AGE from a variety of industries. Principals of the glass manufacturing firms which employ nearly 20,000 people at St. Helens, were uncertain of the effect the cut in allocations would have. Some doubt still existed whether factories producing window-glass for new houses and bottles for food and medicine, would be placed on the special priority list for fuel supplies. (A conference between Board of Trade representatives and manufacturers in the area was to be held early this week).

Mr. Came, chairman of Joseph Crossfield and Sons, Ltd., Warrington, soap and chemical manufacturers, said the industry could not survive on a 50 per cent coal cut. The firm was vitally interested in the manufacture of raw materials for food production, and until they received some communication from the authorities they could not forecast what would be the position.

Cotton manufacturers hoped they would figure high in the list of fuel priorities. A leading member of the Master Spinners' Federation said that a cut to 50 per cent of their allocation would mean extensive mill stoppages. Supplies to more than 10,000 firms have been scrutinised, including 5000 which come under the Supply Ministry. An official of the Dunlop Rubber Company's Speke factory, employing 5000, said that they had been getting by with difficulty for some time. "Last week we got through without trouble, and it looked as if we had a fair start for the coming week. The position will have to be reconsidered," he added.

Stoppages Likely

That any further fuel cuts would involve stoppages was admitted in a statement by the North-West Regional Fuel Allocation Committee. A severe cut in supplies to the I.C.I. factory at Billingham, which employs 14,000 workers, would reduce its production by half. Although output would be very severely restricted, widespread unemployment was not expected. Redundant men would be put on the small amount of alternative work which is available. The committee stated that, as a first step in pursuance of the Government policy, utility services' stocks will be maintained. At the moment they were at a critically low level. Further consideration would be given to the allocation of the residue of coal supplies available for industry, and the committee would meet from day to day. The committee has under consideration the special position of vital industry and such firms would receive aid as early as possible.

Hopes that the forthcoming allocations would be adequate for immediate requirements were dispelled by statements issued on Monday by the Board of Trade, when the prospect of thousands being under employed during the next six weeks was recognised. Cuts in coal supplies to the iron and steel industry were heavier than was anticipated, reducing the tonnage received by some 25 per cent. Steel works, said an official of the British Iron and Steel Federation, had been receiving their full allocations so that the reduction would be a severe blow. A loss of 500,000 tons in the planned output of steel in the next two months was expected and the record output of 13,250,000 tons of steel planned for 1947 could not now be realised.

The Board of Trade has now stated that food industries, some chemical firms and manufacturers of building materials were to have first calls on coal reserve pools. These will be available to rush additional supplies to firms of the highest importance.

Advances in Distillation

Better Products at Reduced Cost

DR. T. J. WALSH, of the Standard Oil Company of Ohio, in a report to the Division of Industrial and Engineering Chemistry of the American Chemical Society, states that sweeping advances in distillation, which is only beginning to be treated as a science, are pointing the way towards better industrial products at lower costs.

Distillation, the process of separating substances by boiling them and condensing their vapours, has been carried out under wide ranges of temperature and pressure, and in the laboratory distillation is used chiefly to separate relatively small quantities of some charge stock for analysis. Measurements of boiling points and refractive indexes, according to Dr. Walsh, are the most commonly used means for determining purity of the distillates obtained.

Basic Problems

"Whether the batch consists of ten millilitres of a synthetic organic chemical or a hundred barrels of crude petroleum, the problems are essentially the same. The charge must be distilled steadily and reproducibly," Dr. Walsh points out. "The components must be separated and each highly purified in a quantity sufficient for identification, there must be as little overlap as possible between successively distilled components, and the time required for the distillation must not be excessive.

"The packed column is best suited to this type of operation. Packings have been developed so that high efficiency columns can be housed within a standard laboratory building, frequently on one floor. One hundred theoretical plates in six feet of packed length are well within the range of practicability.

"The operating holdup of these packings is reasonably low so that a minimum of overlap between cuts may be expected. Unfortunately, the through-put is also lower than we would like, and the time required for a precision distillation is long. A one-hundred theoretical plate distillation at one-hundred-to-one reflux ratio requires about one hundred hours on a charge sufficiently large to give 1 per cent accuracy in the analysis of the components."

Recent progress in the field of laboratory distillation has seen the development of more highly refined equipment and better packing material. Still heads, for example, permit precise regulation of reflux or reflux ratio at all operating rates, and automatic columns make long distilling periods feasible in routine work. "Continuance of these trends," Dr. Walsh predicts, "will make distillation a still more useful laboratory tool. Greater reproducibility of results between laboratories and improved precision of operation within a given laboratory are possible to-day. They are definitely to be expected in the future."

The field of commercial distillation is distinguished by a different set of distillation problems, Dr. Walsh says. The purpose of operation is to concentrate according to a set of specifications a particular product for sale or further processing. Because operating conditions remain virtually constant for months or even years, continuous stills are practical. Towers up to two hundred feet high are found, and bubble plates are commonly used instead of packing.

Recent studies in "tower hydraulics" have disclosed in detail much of what really goes on within an operating tower, and have promoted development of more efficient stills with greater productive capacity, according to Dr. Walsh. The lessons learned point the way to better products at lower costs.

Midland Tar Distillers Record Year

AT the annual meeting of Midland Tar Distillers, Ltd., the chairman, Mr. Stanley J. L. Robinson, stated that during the year to June 30, 1946, the company had handled more tar than ever before.

Gas works crude benzol production had been well maintained, though there was now a substantial decrease in throughput owing to coal shortage.

The company had increased and intended to increase still further its production of tar acids, including carbolic and cresylic acid. There was an expanding peace-time market for these materials, particularly for synthetic resins.

During the year the company continued to supply a large percentage of its make of creosote to I.C.I. for hydrogenation into high octane motor spirit. The possibility of renewing exports of creosote to the United States had opened up and the Company had since shipped supplies to America. Large quantities of pitch had been and were being shipped to France.

The company was playing an important part in the liquid fuel market, though this must be on a smaller scale in future. It was more advantageous to export pitch and creosote than to burn tar liquid fuel 200 (sometimes known as pitch/creosote mixture).

NEXT WEEK'S EVENTS

MONDAY, JANUARY 27

Society of Chemical Industry. Manchester Engineers' Club, 6.30 p.m. Mr. F. A. Jones: "Chemistry and Technology of Organo-Silicon Compounds."

TUESDAY, JANUARY 28

Institute of Physics. Rooms of the Royal Society, 5.30 p.m. Prof. H. S. W. Massey: "Semi-Conductors."

Society of Instrument Technology. Manson House, Portland Place, London, W.1., 7 p.m. Mr. W. C. Fahie: "Some Applications of Electronics in the Iron and Steel Industry."

Institution of the Rubber Industry (London Section). The Waldorf Hotel, Aldwych, London, W.C.2, 6.30 p.m. Dr. L. J. Bellamy, Mr. J. H. Lawrie, and Mr. E. W. S. Press: "The Chromatographic Analysis of Rubber Compounding Ingredients and Their Identification in Vulcanisates."

WEDNESDAY, JANUARY 29

The Textile Institute. Leeds University, 10.30 a.m. Conference on "Modern Methods of Single-Fibre Testing." Coventry, 7 p.m. Mr. L. H. C. Tippett (British Cotton Industry Research Association): "Quality Control in the Textile Industry."

The Institute of Welding. Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1. 6 p.m. "Future Ships—Will they be All-Welded?" (Messrs. J. L. Adam, H. H. Hagan, W. G. John, J. H. Patterson and C. Stephenson).

Royal Society of Arts. John Adam Street, Adelphi, 5 p.m. Mr. W. C. Puckey: "Scientific Approach to Labour Problems."

THURSDAY, JANUARY 30

Imperial Institute (Mineral Resources Department), Cinema Hall, Imperial Institute, S. Kensington, S.W.7., 3 p.m. Mr. J. H. Harris: "A Metallurgist in Tanganyika."

Institute of Welding (East Midlands Branch). Dr. L. Mullins: "The X-ray Inspection of Welds."

Chemical Society. Chemistry Lecture Theatre, Sheffield University, 5.30 p.m. Prof. J. B. Speakman: "Some Relationships Between Structure and Properties of Natural and Synthetic Fibres."

FRIDAY, JANUARY 31

Royal Institution of Great Britain, 21 Albemarle Street, London, W.1, 8 p.m. Prof. E. K. Rideal: "Thin Films on Water."

Royal Statistical Society. 2 Savoy Hill, London, W.C.2, 6 p.m. Dr. B. P. Dudding: "Control Charts Applied to Sales Data."

Institute of Welding (East of Scotland Branch). Dr. J. H. Paterson: "Recent Progress in Plastic Welding."

Chemical Society. Chemistry Department, University College, Dundee, 5 p.m. Dr. W. G. Campbell: "Modern Trends in the Chemical Utilisation of Wood."

B.I.F. Instruments Section

THE Scientific Instruments Section of the British Industries Fair this year will be a composite exhibit expected to cover about 14,500 sq. ft. of the ground floor at Olympia. It is hoped that 86 firms under the ægis of the Scientific Instruments Manufacturers' Association of Great Britain, Ltd., will display scientific instruments of almost every kind. In addition, over 40 firms, not members of the S.I.M.A., have applied for a further 6500 sq. ft. of space. This more than triplicates the number of exhibitors for 1939, when 31 firms, occupying just over 6000 sq. ft., were represented. Non-members of S.I.M.A. are included in the arrangements made by S.I.M.A. for the composite stand, so that the largest and most comprehensive exhibition of scientific instruments will be possible.

Bituminous Coatings

THE chemical research laboratory of the Department of Scientific and Industrial Research has published a review of existing information on the use of bituminous materials for the protection of iron and steel against corrosion (Chemistry Research Special Report No. 5 "Bituminous Coatings for the protection of Iron and Steel against Corrosion," H.M.S.O., 38 pp., 1s.). The booklet has been produced as part of a campaign to reduce the £40,000,000 spent each year in Britain to protect iron and steel from rust.

It points out that the necessity to use tar in wartime as a substitute for many previously imported materials remains in peacetime. The various types of bitumen, tar and pitch are enumerated and their general characteristics given.

Personal Notes

DR. HARDEN F. TAYLOR is president for 1947 of the New York Academy of Sciences.

MR. W. M. CALDERHEAD has become assistant managing director of the United Turkey Red Co., Ltd.

MR. WALTER CAREY, formerly chief engineer of United Alkali, Co., Ltd., Bristol, who died in June last, left £8334 gross, net personalty £6531.

MR. J. H. JOLLY, deputy-chairman, succeeds Sir Charles Wright on the latter's retirement as chairman of Guest, Keen Baldwins Iron & Steel Co., Ltd.

MR. STANLEY ROBSON has resigned from the board of the Imperial Smelting Corporation, Ltd., but has been appointed consultant to that corporation and also to the Zinc Corporation, Ltd., and the New Broken Hill Consolidated, Ltd.

MR. ROBERT PRICE RUSSELL, distinguished American chemist, has been awarded the Cadman Memorial Medal by the Institute of Petroleum. Mr. Russell, who is principal of the Standard Oil Development Company, the central technical and research

Mr. Robert Price Russell.

organisation of the Standard Oil Company (N.J.), is known personally over here, for he visited this country in 1944 as chairman of the Petroleum, Chemical and Rubber Division of the U.S. Strategic Bombing Survey. He rendered valuable service during the war, in recognition of which he received from President Truman the Medal for Merit, highest civilian award in the States. At the present time, Mr. Russell is directing research into new and improved uses for crude oil, into the production of liquid fuels from coal and natural gas, and the development of improved synthetic rubbers and plastics. He will deliver the second Cadman Memorial Lecture early in June.

MR. V. ASHTON has been appointed works manager in the Perspex department of the Willesden factory of Triplex Safety Glass Co., Ltd. Another appointment is that of Mr. C. L. Cripps as works manager in the safety glass department of the same factory.

MR. H. W. SECKER has been appointed chairman and managing director of Thos. W. Ward, Ltd., Albion Works, Sheffield. MESSRS. C. LESLIE FRY, W. W. HICKMAN, R. B. TROTMAN, S. J. DYAL, A. J. WAINFORD, and P. T. WARD have also been appointed directors of the company.

SIR STANDEN LEONARD PEARCE is to be the 25th recipient of the Faraday Medal, awarded by the Institution of Electrical Engineers. This is in recognition of outstanding contributions to the advancement of engineering practice and notable achievements in electrical engineering.

SIR ROBERT WATSON-WATT has relinquished his full-time appointment as Vice-Controller of Communications Equipment with the Ministry of Aircraft Production and Scientific Adviser on Telecommunications with the Air Ministry, but will continue to give some time to consultant work for the Government, acting as Scientific Adviser to the Air Ministry and to the Ministries of Supply, Civil Aviation and Transport.

Obituary

THE EARL OF LEVEN AND MELVILLE, associated with Borax Consolidated, Ltd., died in Nairn Town and County Hospital on January 15, at the age of 56.

MR. JAMES W. DONALDSON, D.Sc., head of the chemical and metallurgical department of Scott's Shipbuilding and Engineering Co., Ltd., Greenock, and one of the foremost authorities in Britain on cast iron, died suddenly at his home, Seaview, Ashton, Gourock. After serving with Colvilles, Ltd., and Beardmore & Co., Ltd., he joined the Greenock firm in 1918, and carried out much important research, particularly in cast iron, for over 25 years. A member of the council of the Iron and Steel Institute, Dr. Donaldson was president of the West of Scotland branch; a member of the Institute of metals; a Fellow of the Institute of Metallurgists; and served on the Technical Committee of the British Standards Institution and British Cast Iron Research Association. Distinctions gained by Dr. Donaldson included the Carnegie Research scholarship of the Iron and Steel Institute in 1914; the diploma of the Institute of British Foundrymen in 1927, and the Oliver Stubb gold medal of the Institute in 1928. All were for papers on research on cast iron.

Home News Items

The address of the Aluminium Development Association is now 33 Grosvenor Street, London, W.1 (telephone, Mayfair 7501/8).

A grain-drying plant is to be set up in Gloucestershire and to be operated jointly by the Milk Marketing Board and Imperial Chemical Industries.

Aluminium production in the United Kingdom during October last totalled 8273 long tons, made up of 2814 long tons of virgin (all unwrought forms) and 5459 long tons of secondary ingot (excluding recovery at Government depots from crashed aircraft).

Streptomycin is to be manufactured at Speke by the Distillers Co., Ltd. It is understood that nearly all necessary technical equipment is available on the site but that factory space is holding up commencement of production.

Messrs. Wild-Barfield Electric Furnaces, Ltd., of Watford, Herts, have acquired larger premises for their Birmingham office and service depot. Their new address will be 21 Steelhouse Lane, Birmingham, 4; telephone Central 6372.

The vast strides made in the past twenty-five years towards discovering the degrees of acidity in paper, were outlined by Mr. S. R. H. Edge, when he led discussion at a recent meeting of the North-east of Scotland discussion group of the Paper Makers' Association, in Aberdeen.

"Employers must watch the vagaries of fashion" was the comment of the Clerkenwell County Court judge, awarding £35 damages to a girl who broke her arm through tripping on a factory floor while wearing shoes with 3¾-in. heels.

The Scottish Seaweed Research Association has received a Treasury grant to cover research in the next five years. The Director, Dr. F. N. Woodward, intimated this at a meeting of the Highland Development League, when he said trials would shortly begin to determine the suitability of North Uist for establishing a factory for processing seaweed.

The Welsh Industries Fair recently held in London, as reported in our issue for January 4, was a success beyond the "widest expectations," according to Coun. Geo. Williams, chairman of the organisers, the Industrial Development Council of Wales. Home and overseas orders at the Fair, roughly computed, totalled £5,000,000, while attendances numbered over 39,000.

A record membership of 3069 is reported by the Textile Institute. During last year 750 new members joined, while, since 1943, there has been an increase in membership of 66 per cent.

Negotiations to amalgamate the Institution of Factory Managers and the Works Management proceeded during last year, and a full report is to be submitted at the annual meeting of the Institution to-day.

The Commodity Credit Corporation is negotiating in Buenos Aires for the purchase of linseed oil and rapeseed oil, it is reported. Argentina's refusal to negotiate with private United States importers and the declining supplies of these oils have led to the negotiations, it is explained.

Among successful candidates for 10 scholarships awarded by the Czechoslovakian Ministry of Education in Britain is Captain M. R. F. Ashworth, B.A.(Oxon.Chemistry), B.Sc.(Oxon.), Ph.D.(Aberdeen), whose subject is soil and chemical problems in Czechoslovakia.

Fears of a serious shortage of zinc, with resultant stoppage of many industrial processes, were expressed at a meeting at Beverley. The chairman, Mr. C. F. Deans, said suppliers of zinc to most industries were the Imperial Smelting Corporation, which had notified customers that no further orders could be accepted after the end of 1946.

The shortage of labour in British foundries is the subject of a warning by Sir Alfred Herbert, writing in the *Journal of the Institution of Engineers*. So acute is it, according to Sir Alfred, that he advocates employment of foreign workers. Unless an adequate supply of labour can be found, he warns, essential production will be held up. The supply of young men to fill higher positions in the foundry industry is also inadequate, he adds.

The annual examinations for certificated studentship in mining engineering (vocational subjects) and mechanical engineering (vocational subjects), under the auspices of the North of England Institute of Mining and Mechanical Engineers, will be held in King's Hall, King's College, Barras Bridge, Newcastle-upon-Tyne, 2, on April 17, at 10 a.m. All information may be obtained from the hon. secretary, Institute Board for Examinations, Neville Hall, Newcastle-upon-Tyne, 1.

Overseas News Items

The manufacture of penicillin is to be started at an early date by the Union Quimica Farmaceutica of Barcelona.

Czechoslovak dyestuff manufacturers are reported to be endeavouring to establish markets in certain dyes in the United States.

Sweden hopes to obtain soda from the Russian occupation zone of Germany. A trade delegation has recently left Stockholm to establish direct contacts.

Extensive occurrences of methane gas have, according to a report published in *Pravda*, been recently discovered near Stalingrad. Daily output of the first well to be brought down amounted to about 500,000 cubic metres.

The co-operation of Travancore Minerals Co., Ltd., whose headquarters are in London, is being sought to promote large-scale exploitation of thorium and some associated important minerals in Travancore, South India, where the deposits are thought to be the largest in the world.

The tin smelter of the Billiton concern at Arnhem, the Hollandsche Metallurgische Bedryven, is now practically restored after war damage, it is reported from Amsterdam, and is working a substantial part of the Billiton tin output, which is now approaching 50 per cent of the 1939 level.

Commemorating the 50th anniversary of the death of the creator of the Nobel Prize foundation, an appreciation of Alfred Nobel, the munitions manufacturer who hated war and poet who was also a businessman, was given by Gustav Hellstrom at the recent annual meeting of the 150-year-old Swedish Academy, which administers the foundation, at which King Gustaf was present.

Production has started in the first superphosphate plant at Kokand, in the Ferghana Valley of Soviet Uzbekistan. Output will chiefly go to the cotton plantations in the Republic which have formerly depended on fertiliser brought from long distances. The erection of a nitrogen plant is planned in this valley, while another superphosphate plant is to be constructed at Samarkand.

Germany's leading atomic authority, Professor Otto Hahn, stated in Hamburg that German scientists, under British supervision, were working on cosmic rays. "Experiments are still in their early days," he explained. "Although the rays do produce energy, it is of low grade and cannot be compared with the energy released by splitting the uranium atom."

The Leipzig plant of the I.G., which is to be dismantled, is at present employing about 50 workers on the production of oxygen.

Exports of sulpha drugs and opiates, the production of which was started in Denmark during the war, are expected to increase.

Sweetening substances, such as Phloxy nitroaniline, which is about 3000 times sweeter than sugar, and ethoxynitroaniline, 1400 times sweeter than sugar, are now being manufactured in Japan.

The U.S. Military Government in Germany has decided to appoint trustees in the individual works which have formerly belonged to the I.G. Farben. The duration o. this trustee arrangement is to last until a final settlement of the I.G. problem—about which discussions are reported to be in progress—has been arrived at.

The Australian Government is reported to be encouraging the growing of *Nicotiana rustica*, to provide nicotine sulphate. It is estimated that about 800 acres must be planted if enough insecticide is to be manufactured to cover the country's requirements.

The American Smelting Company has increased the price of lead from 12.55 to 13 cents a pound delivered in New York, which, the company announces, follows the British Government's action in setting its official selling price in Britain at £70 per ton. At the current exchange and freight rates, the new British basis is equal to slightly more than 13 cents a pound in New York, after adding United States import duty.

The revival of French chemical exports is shown by the fact that France exported in November last 214,000 kilogrammes of nitrate of potash, 183,100 kilogrammes of potassium sulphate, 35 million kilogrammes of potassium chloride and 643,500 kilogrammes of potassium carbonate. Among imports, ammonium sulphate occupied the first place with 4.4 million kilogrammes, followed by calcium carbide with 3.1 million kilogrammes.

Professor M. L. E. Oliphant, of Birmingham University, will, it is reported from Australia, see the Prime Minister, Mr. Chifley, when he visits Canberra. While in Melbourne he was expected to confer with the Australian Council for Scientific and Industrial Research. He has also undertaken to inspect the uranium deposits at Flinders Ridge; already he has seen samples from this field and has expressed optimism concerning them.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 25/1/47.) December 21, disposition by Minister of Supply with consent, granted in implement of a Trust Deed dated September 12, 1934; charged on certain land and buildings in County of Stirling (except, etc.). *£3,182,330. April 12, 1946.

MODERN SYNTHETICS LTD., London, S.W., manufacturers of synthetic leather. (M., 25/1/47.) December 24, £5000 debenture, to Rubber Improvement Ltd.; charged on plant and machinery as set forth in the schedule to the debenture. *—. December 31, 1945.

Company News

The nominal capital of the **Crown Chemical Co., Ltd.,** Osborne House, Park Crescent, Tonbridge, has been increased beyond the registered capital of £5000 by £2000 in £1 shares.

Thos. W. Ward Ltd., Albion Works, Sheffield, have purchased the whole of the share capital of Birchley Rolling Mills Ltd., Oldbury. The company will continue under the present name.

A net profit of £245,239, as against £214,737 for the previous year, was reported at the annual meeting of Roan Antelope Copper Mines, Ltd. A dividend of 6d. per unit of stock or share was recommended.

Benn Brothers, Ltd., publishers of THE CHEMICAL AGE, have declared the following dividends, less tax, payable on February 15, 1947, viz.: 3 per cent. on the Preference shares for the half-year ended December 31, 1946, and interim dividend of 5 per cent. on the Ordinary shares (same).

The nominal capital of **Theodore St. Just & Co., Ltd.,** chemical manufacturers, etc., Shorrolds Road, London, S.W.6, has been increased beyond the registered capital of £1000, by £9000 in 6000 6 per cent., and 3000 10 per cent cumulative redeemable preference shares of £1.

New Companies Registered

Swanwick Laboratories, Ltd. (426,943).—Private company. Capital £500 in 500 shares of £1 each. Manufacturers of and dealers in chemicals, etc. Directors: A. Cole; T. Clarkson. Registered office: Appletrees, Bridge Road, Lower Swanwick, Hants.

Anderson Bros. (Leeds), Ltd. (427,472).—Private company. Capital £500 in 500 shares of £1 each. Manufacturers of and dealers in chemical and other fertilisers, etc. Subscribers: A. and G. Anderson, 75 Copgrove Road, Leeds, 8.

Pash Chemicals & Synthetics, Ltd. (427,684).—Private company. Capital £3000 in 3000 shares of £1 each. Manufacturers, etc., of chemical and allied products, chemicals, plastics, synthetics, etc. Directors: Z. Pashkovietzky, M. Pashkovietzky. Registered office: 7-8 Idol Lane, London, E.C.3.

Arcanum Ltd. (427,473).—Private company. Capital £2000 in 1900 5 per cent participating cumulative preference shares of £1 each and 2000 ordinary shares of 1s. each. Manufacturers of and dealers in chemicals, etc. Directors: N. Colin, D. Harmer. Registered office: 4 Berners Street, London, W.1.

Mac-lav-ac Corporation, Ltd. (424,652). Private company. Capital £1000 in £1 shares. Industrial research chemists and engineers, manufacturers of specialised plant and machinery, manufacturers of chemicals, gases, salts, oils and other compositions and materials, etc. Directors: G. Sadler, Raydons House, Dagenham; E. Sadler.

National Glass Industry (Tottenham) Ltd. (426,172).—Private company. Capital £10,000 in £1 shares. Manufacturers of and dealers in analysis, chemical, scientific and other apparatus and equipment, etc. Directors: A. Kahl; W. Gerlach. Registered office: 1, Fountayne Road, Broad Lane, Tottenham, London, N.15.

Hughjo Products (Whitstable) Ltd. (426,432).—Private company. Capital £500 in £1 shares. Manufacturers of and dealers in filtering and purifying apparatus and plant, water softening plant and materials, manufacturing and retail chemists and druggists, etc. Directors: S. L. Hughman; J. L. Jacques; R. Puppin. Registered office: 2a, Albert Street, Whitstable.

Chemical and Allied Stocks and Shares

AFTER showing further expansion with dealings reaching their largest volume since pre-war days, business in stock markets contracted, and earlier sharp gains in industrial shares were followed by moderate profit-taking, reflecting the serious position referred to in the Government White

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Paper on economic conditions. Nevertheless, in many directions share values were again higher on balance, though iron and steels lost ground on the latest fuel news, and textile shares suffered a reaction. There was further selling of electric supply shares, holders generally recognising the big loss of income involved in the nationalisation terms. Home rails have been inclined to strengthen, but British Funds became easier. The latest batch of dividend announcements of industrial concerns created a good impression and in some instances have indicated the benefits from Dominion tax relief that can accrue to companies with important overseas interests.

Imperial Chemical have been firm at 47s. 1½d., but later eased to 46s. 6d., showing a not unattractive yield on the basis of the 8 per cent dividend basis which has ruled for some years. It is generally expected that sooner or later a somewhat less conservative dividend policy is likely, though this will apparently turn in a large measure on the extent that benefits are derived from the abolition of E.P.T. and also the position in regard to Dominion income tax relief. B. Laporte were again 103s. 9d. This is another instance where E.P.T. has borne heavily on profits in recent years. Fisons at 67s. have been firm. In other directions market hopes of a higher dividend for the financial year ended September 30 last drew further attention to Borax Consolidated deferred at the higher level of 49s. 9d. Turner & Newall, after a further advance, receded to 93s. 9d., while United Molasses at 57s. 6d., Dunlop Rubber at 75s. 3d. and Distillers at 139s. were also below best levels touched recently. Further consideration of the results and centenary bonus has advanced Nairn & Greenwich to 91s. 3d. Murex rose to 101s. 10½d., and Imperial Smelting to 22s. 6d. There was more business among plastics shares, De La Rue rallying to £15, awaiting further details of the developments recently foreshadowed by the company. British Industrial Plastics 2s. shares moved up sharply to 9s. 7½d., and Kleemann shares have continued prominently active, rising to 97s. 6d. before falling to 88s. 9d.

The latest fuel news put United Steel back to 27s., while Stewarts & Lloyds 60s., Babcock & Wilcox 71s. 6d., Colvilles 25s. 6d., and Dorman Long 27s. 4½d., also showed moderate reactions after last week's gains. There was, however, little selling reported; it is recognised that in most cases yields are attractive, and that the iron and steel industry probably has a reprieve from nationalisation for at least two years. British Drug Houses became more active and strengthened to 65s. Burt Boulton were 26s. 10½d., and W. J. Bush 91s. 10½d., while Copper McDougall were quoted at 45s. Morgan Crucible "A" ordinary displayed firmness at 60s. Elsewhere there was activity in Low Temperature Carbonisation 2s. units, which strengthened further to 4s. 10½d. Boots Drug at 67s. 6d. moved higher, but later came back to 66s. Beechams deferred strengthened on estimates of the next interim payment, while Sangers were good at 37s. Elsewhere, General Refractories have been firm at 24s. on higher dividend possibilities. British Plaster Board were 34s., and Associated Cement eased to 68s. after an earlier rise. Oils displayed activity, but failed to hold best levels, though Shell touched 97s. 6d.

British Chemical Prices

Market Reports

CONDITIONS generally in the industrial chemicals market are steady with contract deliveries fairly satisfactory. At the same time the supply position, if anything, is tighter, particularly where production is curtailed by fuel shortages. There is also a substantial export inquiry and an increasing home demand which make the position more acute. Price movements are mostly on the upward trend and while there have been no important changes reported this week higher quotations are expected. Coal-tar products remain unchanged and steady.

MANCHESTER.—There is well-sustained pressure for supplies of both light and heavy chemicals on the Manchester market and home trade inquiries during the past week, especially for the alkali products, have been numerous. Export inquiries have also been strongly in evidence. Plenty of additional business is offering in both sections of the trade, but the supply position of some of the soda compounds, due in the main to the fuel shortage, is becoming tighter if anything and no easing of the situation is looked for until coal becomes more freely available. In consequence, the outlook for the consuming industries, including the textile finishing trades in Lancashire and the West Riding of Yorkshire, is becoming increasingly anxious.

GLASGOW.—Conditions in the Scottish heavy chemical market continued to be extremely active during the past week. There has been an exceptionally heavy demand for all classes of chemicals and raw materials. In view of the cuts in the supply of alkali, inquiries have been of an unprecedented nature. Prices are still very firm and, in most cases, increased on last year. In the export market orders have been received for sulphuric acid, copper sulphate, zinc oxide, magnesium sulphate, fluorspar, and Glauber salts, but in this market as well, shortages are continuing to affect the ability of suppliers to accept business.

Patents in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Vapour discharge vessels.—Brown, Boveri, & Cie A.G. 36885.

Freezing apparatus.—Drammens Jernstoberi & Mek. Vaerksted, and T. W. Tharaldsen. 37067.

Sulphonyl chloride.—Allied Chemical & Dye Corporation, and H. J. Fitzpatrick. 36793.

Finishing metal surfaces.—American Chemical Paint Co. 36907-8.

Copper sulphide minerals.—American Cyanamid Co. 36705.

Crystallisation apparatus.—P. d'Ans. 36592.

Pesticides.—Ashe Laboratories, Ltd., and M. D. Price. 36879.

Electro-deposition of metals.—W. Bate, Ltd., and P. Berger. 36917.

Electrolytic capacitors.—N. H. Bentley, K. S. Oliver, and Telegraph Condenser Co., Ltd. 36467.

Fluid-jet injectors.—Blaw-Knox Co. 36561.

Impact pulverisers.—Blaw-Knox Co. 36831.

Bleaching of cellulosic matter.—R. Bloch, K. Goldschmidt, P. Goldschmidt, I. Schnerb, and Palestine Potash, Ltd. 36497.

Cellulose ethers.—British Celanese, Ltd. 36853.

Piezoelectric crystal units.—Brush Development Co. 36836.

Degreasing hides, etc.—J. Burchill, J. H. Sharphouse, and I.C.I., Ltd. 36542.

Polymide fibres.—A. Butterworth, and P. F. Crosland.

Complete Specifications Open to Public Inspection

A method and a plant for continuously cooling and solidifying by temperature lowering substances that are liquid in the heat and particularly, pitch, bitumen, asphalt, resins and the like.—N. Baville, and Huiles, Goudrons et Derives. June 12, 1945. 25251/45.

Polymerisable polysiloxane compounds and copolymers thereof.—British Thomson-Houston Co., Ltd. June 11, 1945. 16954/46.

Methylvinyl polysiloxane-methyl methacrylate copolymers.—British Thomson-Houston Co., Ltd. June 11, 1945. 16955/46.

Methyl silicone elastomers containing si-bonded vinyl radicals.—British Thomson-

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Houston Co., Ltd. June 11, 1945. 17100/46.

Methyl silicone elastomers.—British Thomson-Houston Co., Ltd. June 11, 1945. 17374/46.

Methyl silicone gums and elastomers.—British Thomson-Houston Co., Ltd. June 11, 1945. 17375/46.

Preparation of alkenyl-substituted chlorosilones.—British Thomson-Houston Co., Ltd. June 11, 1945. 17376/46.

Determining the constitution of a material, for example a tin solder, having a transformation point of temperature.—Continental Can Co., Inc. June 15, 1945. 17655/46.

Organo-silicon polymers.—Corning Glass Works. March 30, 1943. 7572/44.

Means for pulverising liquids.—A. A. A. Darche, and Vulcanesti, Soc. Anon. June 12, 1945. 24386/46.

Nitration process of toluene.—De Directie Van de Staatsmijnen in Limburg. June 12, 1945. 29702/46.

Washing gases.—De Directie Van De Staatsmijnen in Limburg. June 12, 1945. 29703/46.

Process of neutralising acid, phosphate containing solutions of calcium nitrate.—De Directie Van de Staatsmijnen in Limburg. June 12, 1945. 30068/46.

Complete Specifications Accepted

Process and apparatus for the continuous generation of gases by reaction between air and liquid or pulverulent combustible material.—Anglo-Saxon Petroleum Co., Ltd., I. Lubbock, and F. J. Battershill. Jan. 24, 1940. 583,211.

Separation of suspended particles from vapours or gases.—J. C. Arnold. (Standard Oil Development Co.) Sept. 21, 1943. 583,176.

Production of sodium and potassium salts of aminomethionic acid.—M. H. M. Arnold, W. E. Perry, and I.C.I., Ltd. Nov. 7, 1941. 583,164.

Polymerisation and interpolymerisation of ethylene.—R. G. R. Bacon, R. B. Richards, and I.C.I., Ltd. Jan. 6, 1943. 583,166.

Process for the production of lactones.—J. G. M. Bremner, D. G. Jones, and I.C.I., Ltd. Oct. 20, 1944. 583,344.

Processes of and apparatus for the production of alkali cellulose.—British Cellophane, Ltd. Sept. 10, 1943. 583,269.

Carburisation of steel and the like.—British Iron & Steel Corporation, Ltd., H. L. Riley, and J. Taylor. July 1, 1942. 583,165.

Metallisation by electrodeposition of plaster and like highly porous material.—Callender-Suchy Developments, Ltd., and C. T. Suchy. Oct. 19, 1944. 583,342.

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CHEMIST, 25-35, for analysis of raw materials and manufactured products, for S.W. Lancs., factory manufacturing fertilisers and insecticides. Permanent position. Experience in this trade desirable. State qualifications, experience, age and salary required. Box No. 1377, S. C. Peacock, Ltd., 21, Leigh Street, Liverpool.

MANAGER required by export merchants for chemical trade; must have full knowledge of chemical export trade. Preference given to person holding such a position now. Write in confidence stating salary required and references. Box 2418, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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OILWORKS Chemist wanted. Knowledge of raw materials desirable, experience of distillation an advantage. Interested in plant and process efficiency. State age, education, experience and salary required. Box No. 2405, The Chemical Age, 154, Fleet Street, London, E.C.4.

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